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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXVII NO. 18 SAN FRANCISCO, OCTOBER 28, 1911 PER COPY, 25 CENTS

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Alphabetical Index to Advertisers, Page 8. Where to Buy It in the West, Pages 9, 10, 12.

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Fig. 1 shows cable pulled into conduit pipe with polygonal bushing screwed on to the pipe.

Fig. 2 shows inside clamp device screwed into polygonal bushing.

Fig. 3 shows lead sheath pulled above clamp ring to show belled-out lead.

Fig. 4 shows threaded end offinside clamp device used as templet for belling out lead sheath.

Fig. 5 shows completed 13,200 volts, 250,000 C. M. insulation completed.

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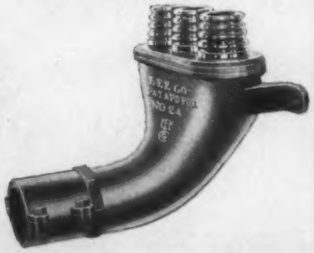

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JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXVII SAN FRANCISCO, OCTOBER 28, 1911 NUMBER 18

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LONG BEACH POWER PLANT

BY A. H. HALLORAN.

The Southern California Edison Company has completed and is now operating the first unit of its great steam plant at Long Beach near Los Angeles, California. The prototype for an ultimate development of eight similar units and embodying the latest and most improved practice in the generation of electric power from fuel oil, this initial installation of a 15,000 kilovolt ampere turbo-generator and accessories is of considerable interest. It is designed as an auxiliary to the Company's six hydroelectric plants on Mill Creek, Santa Ana River, Lytle Creek, Kern River and is primarily intended to take care of peak loads and to insure the consumers against the service interruptions so liable in the long distance transmission of electric power from distant water plants.

Fig. 1. General View of Long Beach Power Plant During Construction.

The site is well chosen, both as regards ample space for plant expansion and abundant water for steam condensation. Situated on a ten acre plot of

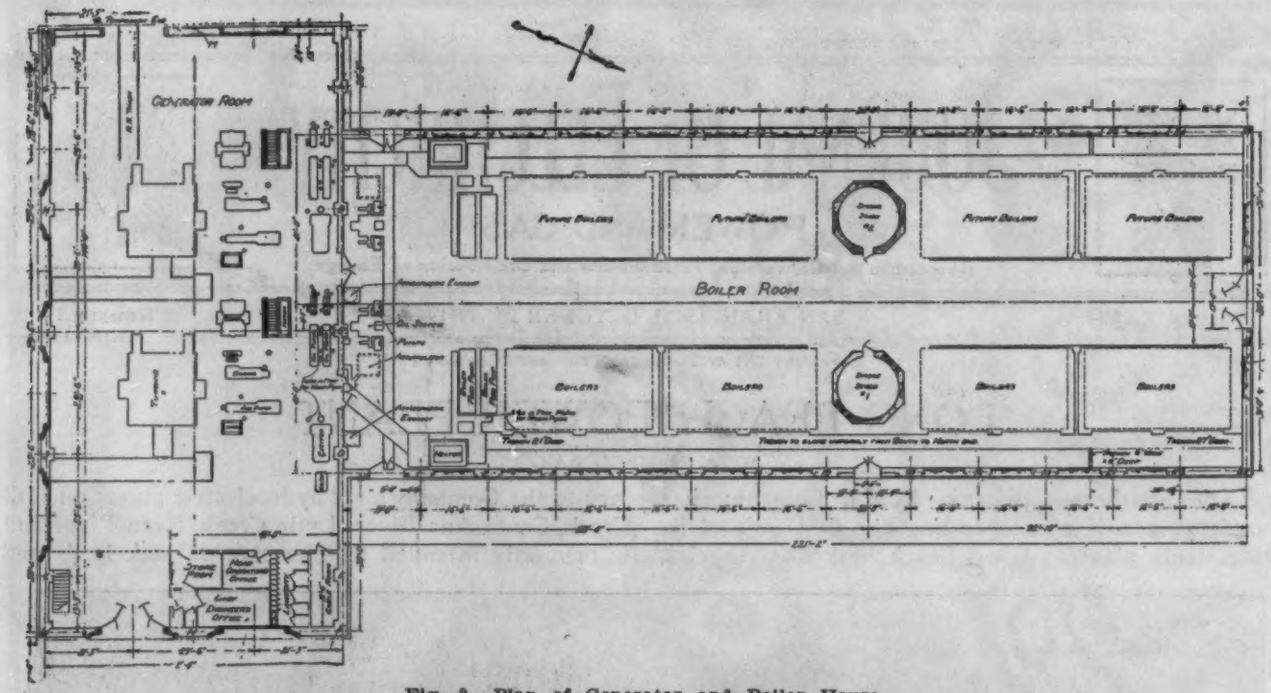

Fig. 2. Plan of Generator and Boiler House.

ground where the Long Beach Inner Harbor channel joins the Pacific Ocean, a never-failing source of cold sea water will always be available. For the present installation, however, the Inner Harbor channel suffices to supply the circulating water, giving greater freedom from bubbles, sand and seaweed than would a surf pier.

The accompanying picture illustrates this situation in a most striking manner and also shows the intake, the transformer house, the generator and boiler house and the discharge conduit during construction.

Fig. 3. Boiler Feed Pumps.

The two main buildings are reinforced concrete structures with steel roof trusses and concrete roof slabs. Ornamental copper cornices and artificial stone bases and abuttments lend a most pleasing appearance which is further enhanced by the mission tile roofing and smooth plaster finish, inside and out. The foundations for the building and the heavier machines are carried on piles. The generator room is floored with tiling and glazed tile is used in the wainscoting. The windows are of metal sash.

The generator and boiler house has a floor area of 30,000 sq. ft. and stands 60 ft. high. The accompanying line drawing shows the general layout for the first two units and indicates the ease with which the system can be extended. As will be noted, each unit comprises a prime mover and generator with its condenser and attendant auxiliary machinery, together with boilers and independent switchboard equipment. This arrangement has many advantages, not the least of which is that during construction each unit can be completed and put in operation without waiting for other portions of the plant. The switchboard gallery extends across the east end of the turbine room and commands a view of the entire generating floor. Under it are various offices, store rooms, etc., and over it are the rheostats and storage batteries. A 50 ton Shaw crane with a 5 ton auxiliary hoist is provided.

Steam Equipment.

Steam is supplied at 125 lb. pressure and 125 degrees superheat from eight Stirling boilers equipped with Babcock-Wilcox U-tube superheaters. Each boiler has a heating surface of 7,775 sq. ft. and the four batteries of two each are capable of evaporating 240,000 lbs. of steam per hour from and at 212 degrees Fahrenheit.

Fuel oil is drawn from two auxiliary tanks fitted with live steam heater coils and each having a sufficient capacity for a 24 hour run with two units. These in turn are to be supplied from two 9,000 bbl. oil storage tanks placed near the railroad track. The oil is forced to the Hammel burners by two 7½ x 5 x 6 Worthington pumps, after it has been preheated to about 130 degrees in a 400 h. p. American feed-water

heater. A Moore patent automatic fuel oil regulating system provides central control of oil, steam and air supply for combustion purposes.

The two stacks are of reinforced concrete with octagonal base and circular section, 150 ft. high with 15 ft. 4 in. base and 12 ft. 6 in. top diameter. A fire brick lining extends 60 ft. above the level of the boiler floor. The base of one stack is fitted as a lavatory with showers and lockers, the other being used as a storeroom. Two concrete smoke flues enter the stack from either side. These flues are 6½ ft. wide with trapezoidal sections 5 ft. 6 in. at the smaller end and 12 ft. 6 in. at the stack discharge. They are provided with expansion joints and clean-out doors.

The boiler feed water supply is maintained by two compound duplex Snow pumps 12 and 18 x 10 x 18, a 7,000 h.p. Cochrane feed water heater being provided.

A noteworthy feature of the equipment is the several measuring devices employed. These include two Worthington water weighers, the larger for weighing the condensate, being equipped with a special tank used as a hot well, and the smaller being used to weigh the make-up water which is obtained from a well on the property. General Electric steam and water flow meters are also employed.

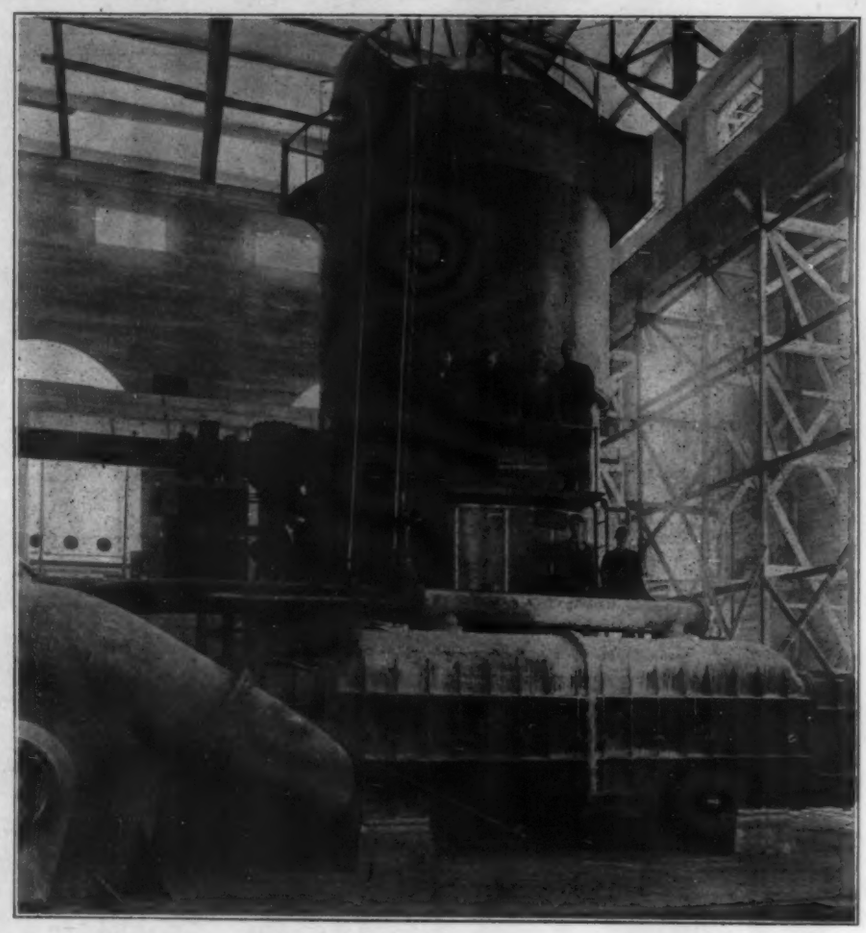

Fig. 4. 15,000 k.v.a. Turbo-Generator with Condenser Base.

The high pressure piping is all equipped with Van Stone joints, corrugated steel gaskets and forged steel flanges. The fittings are of cast steel and 85 per cent magnesia covering is used throughout. The main header is equipped with electrically welded nozzles leading to the auxiliaries. In the 250 ft. length of the 14 in. main header there are no expansion joints or loops, all expansion being taken up in flexible leads to the boilers.

The low pressure piping, including the main exhaust, auxiliary exhaust, circulating water, vacuum and hot well suction and discharge, etc., are of standard construction and are carried in the basement

The turbo-generator is an eight pole General Electric type ATB alternator driven at 750 r. p. m. by a vertical Curtis turbine with condenser base. Three phase current is generated at 50 cycles, 11,000 volts, the generator being rated at 15,000 kilovolt amperes.

Excitation current is furnished from two 125 4-pole General Electric 125 volt dynamos, driven at 2,400 r. p. m. by horizontal Curtis turbines operated non-condensing. Oil for the step bearings is supplied at a pressure of 1,000 lb. per sq. in. by two Dean Bros. oil pumps, 12 x 2⅞ x 12.

Condensing water is brought from the Inner Harbor channel through an intake fitted with inclined racks and eight sets of duplicate screens, 56 inches by

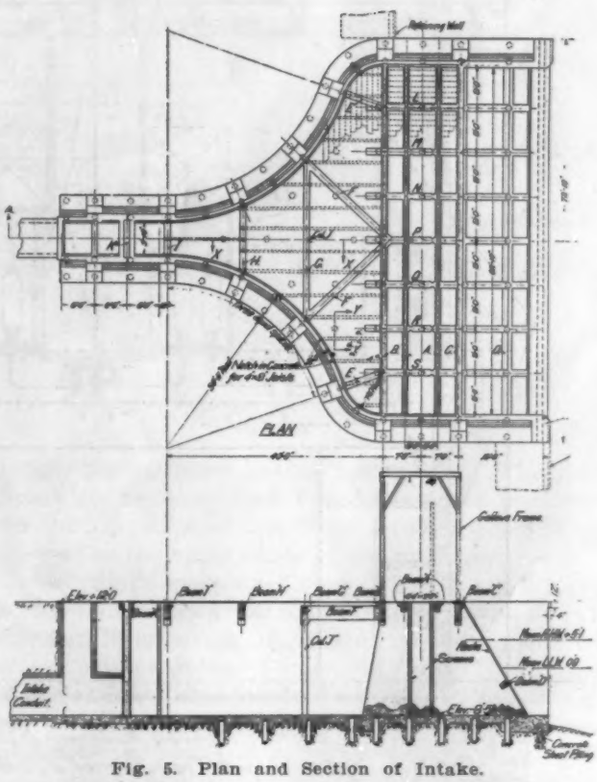

Fig. 5. Plan and Section of Intake.

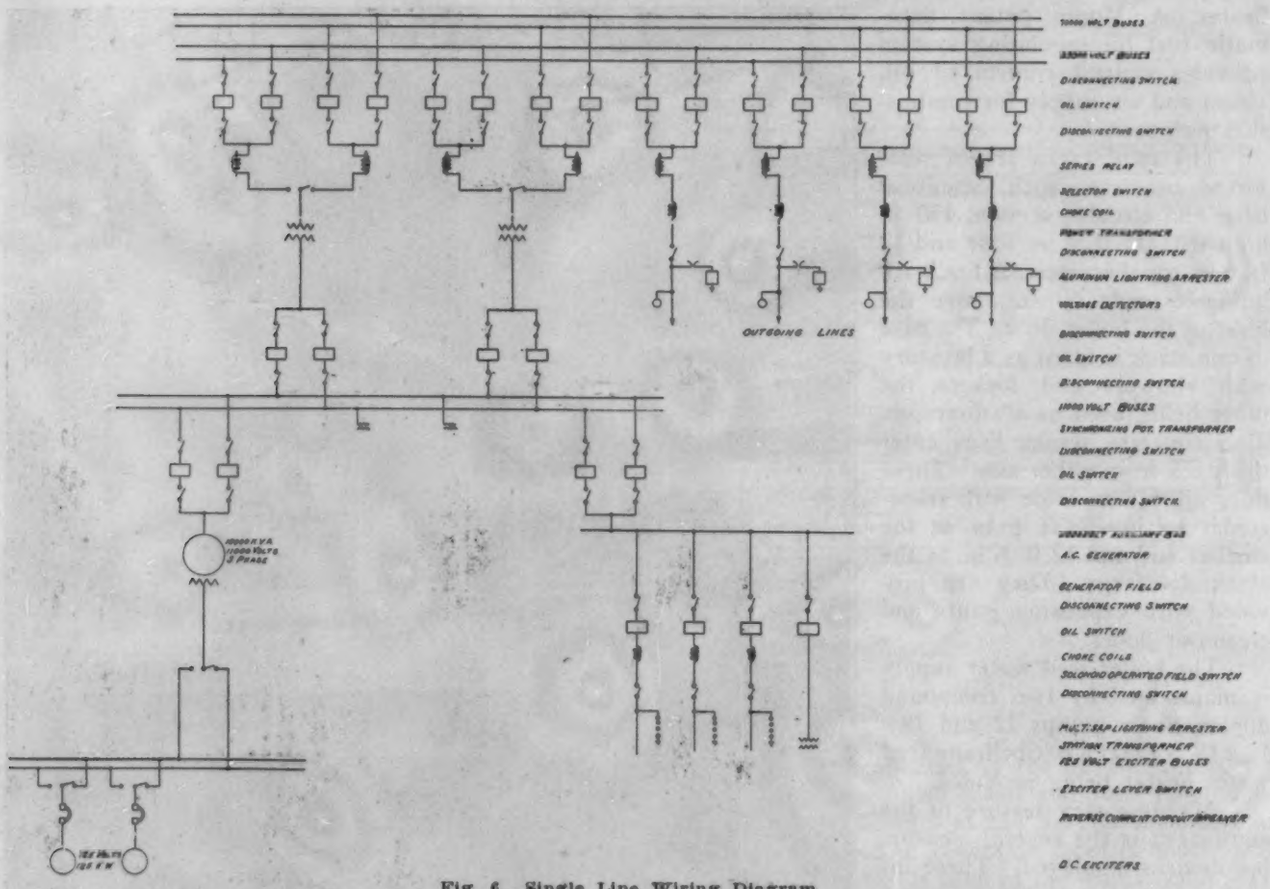

Fig. 6. Single Line Wiring Diagram.

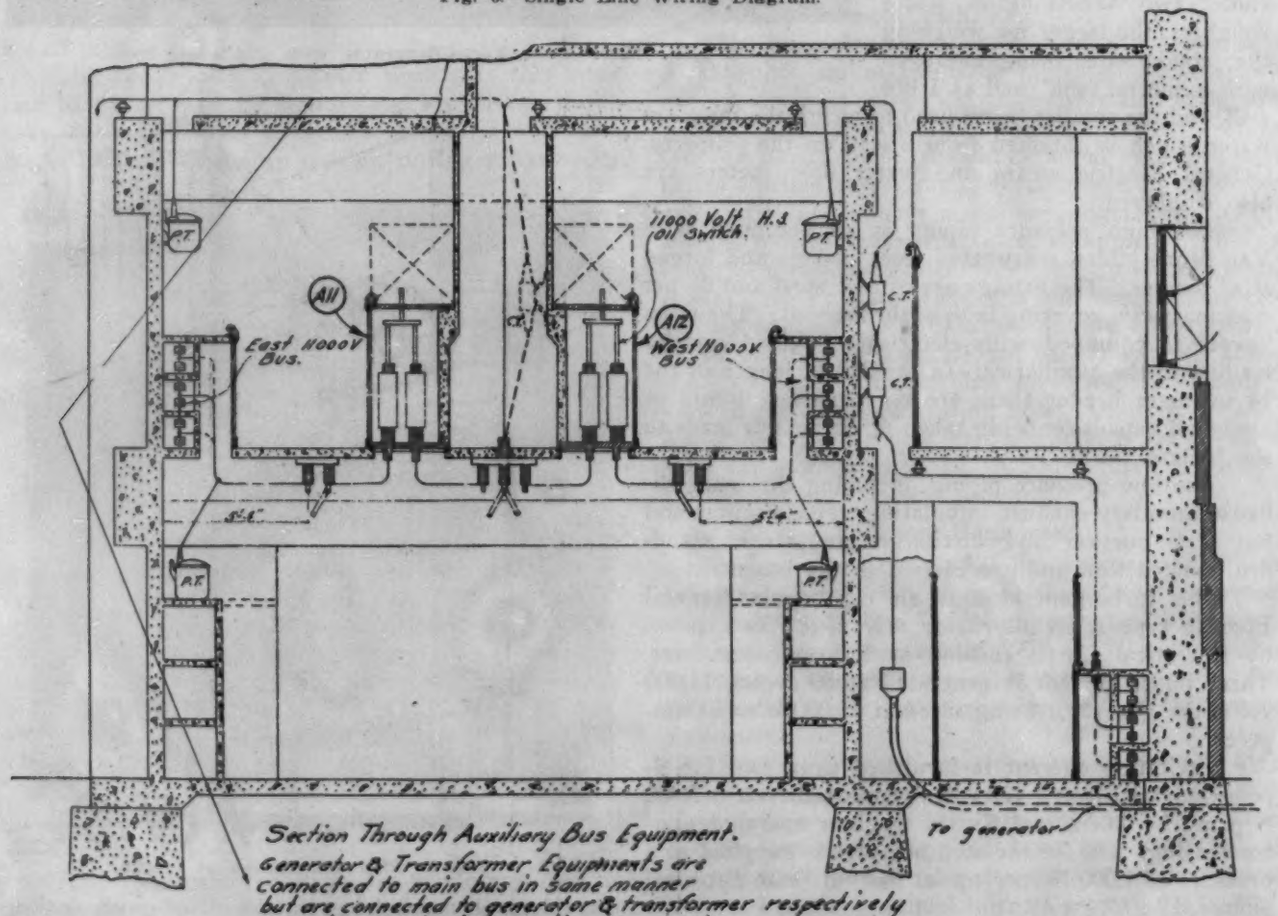
11000 Volt H.S. Oil Switch.
PT
All
Al2
East 11000V Bus.
West 11000V Bus
C.T.
Section Through Auxiliary Bus Equipment.
Generator & Transformer Equipments are connected to main bus in same manner but are connected to generator & transformer respectively as shown in broken sections.
Current transformers for transformer equipments are mounted as shown dotted.
to generator

Fig. 7. Section Through Auxiliary Bus Equipment.

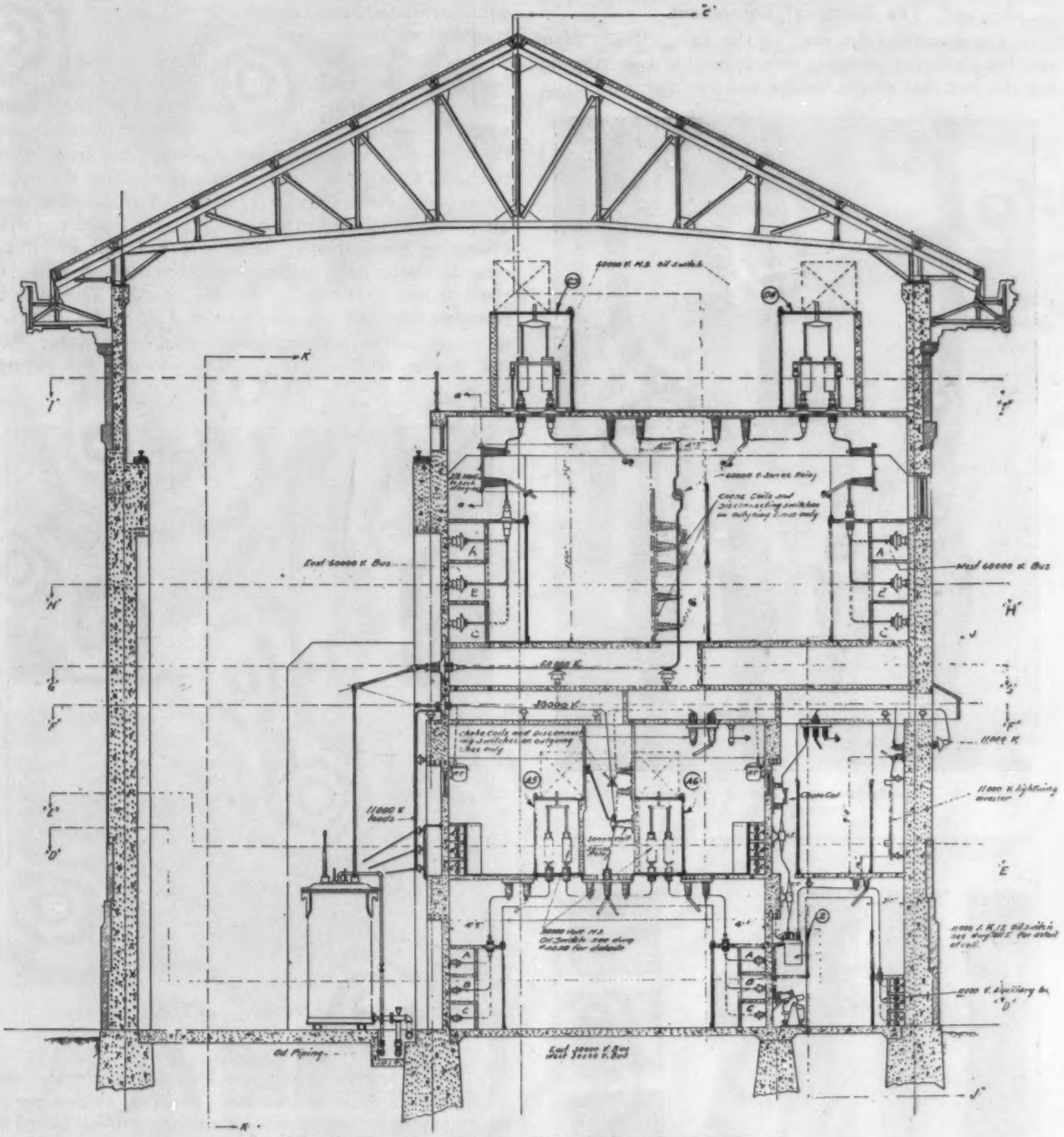

Fig. 8. Transverse Section Through Transformer House.

8½ ft. The screens are of 1 in. and ½ in. mesh respectively and are placed 6 ft. apart. Gallows frames are provided so that they may be hoisted from their grooves and cleaned. The intake conduit is of reinforced concrete with horseshoe section, being 6½ ft. high and 5½ ft. wide. Its top is 2 ft. below the level of low tide. This conduit extends under the transformer house to the generator room.

Here a 30 inch double suction Krogh centrifugal pump, driven at 240 r. p. m. by a 14 x 18 Harrisburg single cylinder engine, supplies 24,000 gallons per minute against a 35 ft. head to the main and auxiliary condensers.

The main condenser in the turbine base is a Wheeler dry tube type having 16,000 sq. ft. of cooling surface, the auxiliary having 5,500 sq. ft. The condensers are equipped with Volz heaters, the discharge from the 5 in. Wheeler centrifugal hot well pump being delivered to the upper tubes of the condenser.

Vacuum is maintained by a Wheeler rotative dry vacuum pump with 12 in. steam cylinder, 30 in. air cylinder and 18 in. stroke. A 36 in. Crane atmospheric relief valve is provided. The cooling water discharges through a 36 in. cast iron pipe into the reinforced concrete conduit leading to the channel, a syphon system being obtained between the intake and discharge conduits.

All of the equipment excepting the generator and other electrical equipment was furnished and installed by Chas. C. Moore & Co., engineers, of San Francisco.

The Electrical Equipment.

The electrical features of the Long Beach plant involve a number of novel points, most noteworthy being the fact that all the busbar and switching construction has been performed by an outside firm of specialists, the company's engineers exercising only a general supervision. The advantages of this method are obvious, as a company making a specialty of such installations, can thus relieve the operating company of much tedious detail.

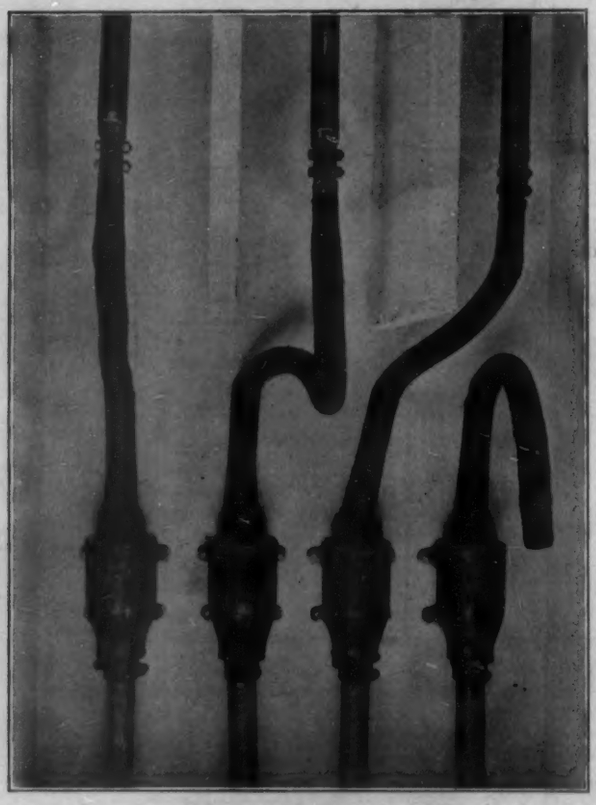

Fig. 9. Interchangeable Flexible Generator Lead Connections.

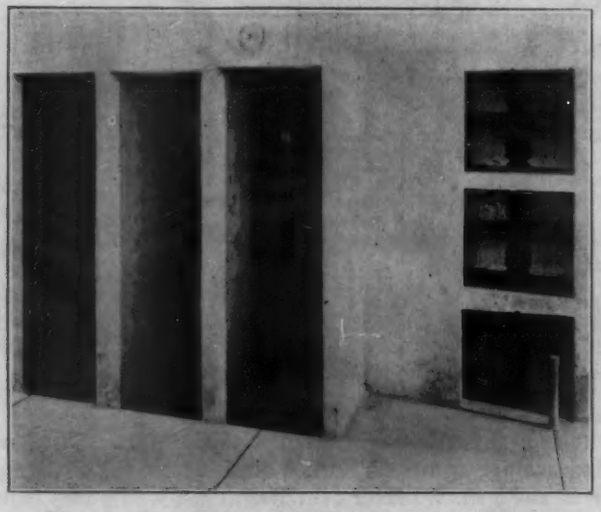

Fig. 10. Transformer Tap of 11,000 Volt Generator Bus.

The general scheme is best shown by the accompanying single line wiring diagram. As the details of the generators and exciters have already been given and as the switchboard is of standard construction and equipment, particular emphasis will be laid upon the transformer house construction.

The power house switch control consists of bench board and two vertical boards with the usual instrument equipment. The generator field switches are solenoid operated and asbestos covered wire is used throughout. A consistent color scheme has been adopted as follows: blue covered wire is used for the upper elements of meters and red for the lower, black is used for grounds, black and white for positive and negative operating buses respectively, and red and green for circuit closing and opening switches, corresponding to the red and green lights on the board. The switchboard gallery has a double floor and all cables and conduits are carried in trenches covered by movable floor plates, thus at once being easily accessible and yet out of the way.

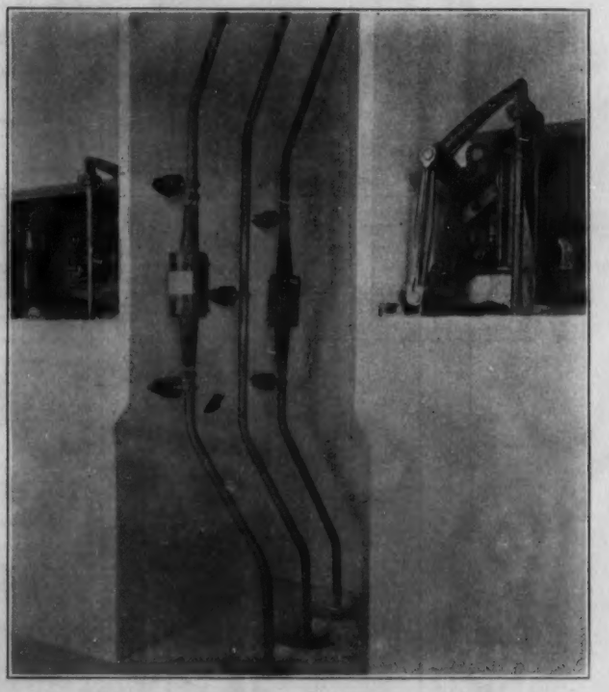

Fig. 11. Method of Supporting Current Transformer.

The generator leads are 1½-million circular mil cable with 11-16 in. fibre core. The four cables one of which is a spare are carried from the terminal board of the generator frame through brass tubing to the floor, whence by means of a basement trench they are carried in Orangeburg fibre conduit to the transformer house. Three reactance coils are placed in series with these leads so as to limit short circuit currents, each being rated at 50 cycle, 300 k. v. a., 381 volts, 788 amperes.

These four leads terminate in cable and bells whence flexible interchangeable connection can be made to the three generator tube conductors in the transformer house, as shown in the accompanying illustration.

Copper tubing is used throughout this entire installation instead of the more usual bar conductors, as it has a larger radiating surface and greater conducting area. It is also more rigid and able to withstand magnetic attraction between adjacent buses in case of heavy short circuit currents.

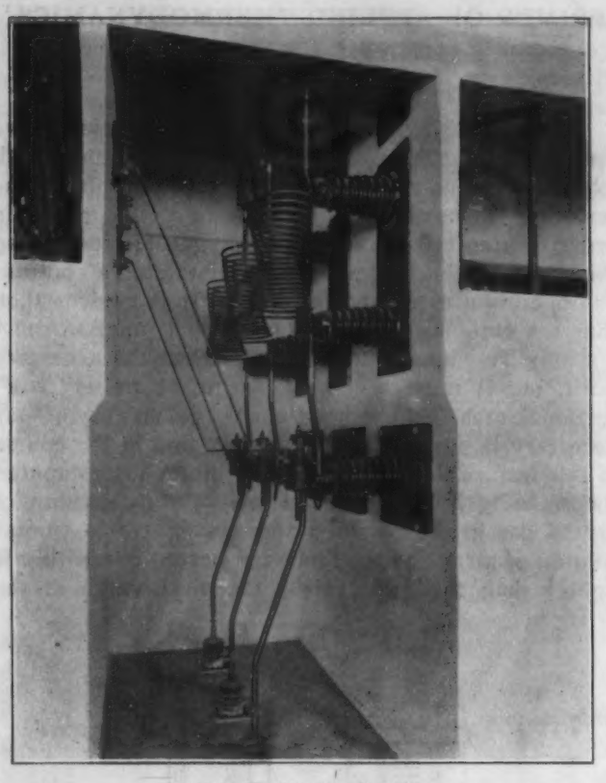

Fig. 12. Series Relay.

The generator conductors are of 2 in. extra heavy copper tubing, iron pipe size, carried vertically on standard round bus-bar supports through General Electric current transformers and double throw dis-

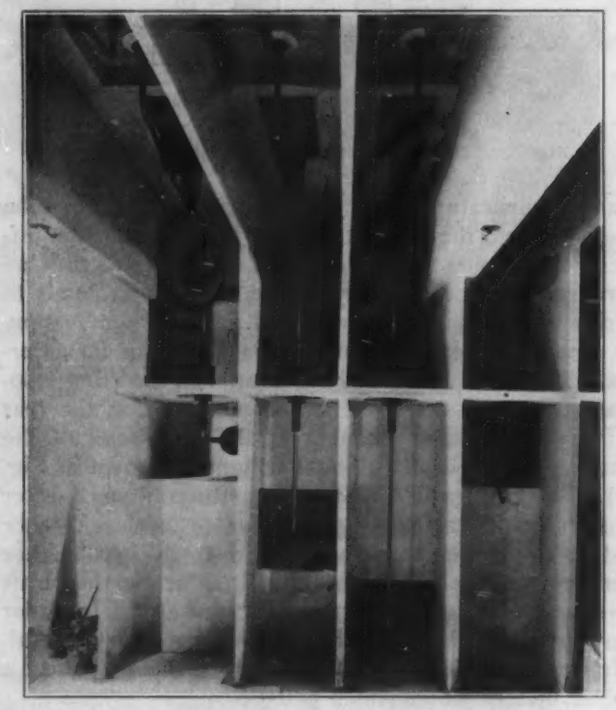

Fig. 13. High-Tension Bus Construction.

connecting switches to the 800 ampere H-3 oil switches and thence to the generator buses.

A novel method of mounting the current transformers is consistently maintained throughout the building. These transformers are ordinarily fitted with supporting feet to be attached to the wall. These feet have been removed and the transformer mounted as an integral part of the line as shown in the accompanying illustration.

The two generator buses are of extra heavy 2½ in. copper tubing and extends the length of the building, being carried in 14 in. square compartments with 16 in. centers on bus-bar insulator double supports. These compartments are 2 in. thick and consist of concrete reinforced with metal lath.

Power at 11,000 volts is taken from the buses to the transformers in the reverse order, as shown by the dotted line in the accompanying drawing of the section through the auxiliary bus equipment. Current likewise is taken from the generator buses to the auxiliary buses on the first floor on the west side of the building. Thence the three 11,000 volt lines are brought through disconnecting switches and K-12 solenoid operated oil switches for distribution to near-by consumers and for station use. These 11,000 volt out-going lines are pro-

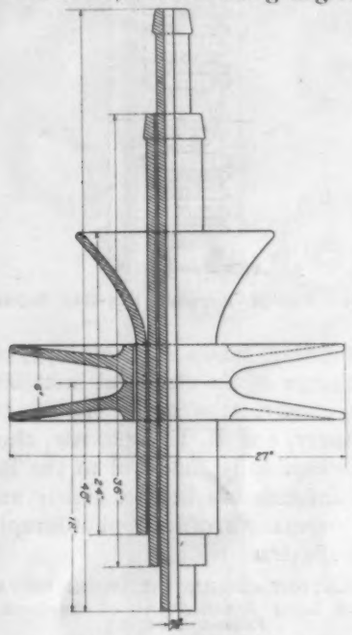

Fig. 14. Special Outside Service Wall Bushing for 80,000 Volt Delta.

tected by multiplex lightning arrestors and overhanging hoods. The method of supporting the generator buses and the transformer taps is well shown in the accompanying view.

The type FO, form A, 50 cycle, 2,000 kw. transformers step up the voltage from 11,000 to either 30,000 or 60,000 transmission potential according to the voltage of the transmission system into which this plant is feeding. They are arranged in two banks of three, one spare also being provided. They are delta-connected on the low tension side and Y-connected on the high tension side.

Conductors from the transformers are 1¼ in. copper tubing passing through a series relay, thence to a double throw disconnecting switch and H-3 oil switches to the 30,000 volt buses which are carried on the high tension insulator supports as illustrated. Power is taken from the buses in reverse order. The arrangements for the 60,000 volt lines are the same ex-

cept that the buses are of 1 in. copper tubing. On account of its stiffness and because of the absence of other support for the series relay, 1¼ in. tubing is used for this purpose. The high voltage lines leave the building through a service bushing. The details of which are shown in the accompanying sketch.

Both the 30,000 and 60,000 voltages are protected by aluminum cell lightning arrestors mounted on steel frame outside of the building. All the oil switches in this installation were manufactured by the General Electric Co. The fittings, bus-bar supports, etc. were furnished by the Electrical Engineers Equipment Co. and installed by J. C. Farrar & Co. of Los Angeles, their Western representatives.

This great plant stands as evidence of the foresight and ability of the vice-president and general manager of the Southern California Edison Co., W. A. Brackenbridge, under whose personal supervision it has been constructed. F. A. Sargent of Chicago was

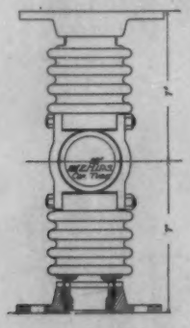

Fig. 15. Double Support Bus-Bar Separator.

consulting engineer, James A. Lighthipe, electrical engineer, had charge of the electrical installation, H. W. Dennis, was construction engineer, E. H. Warner, resident engineer, and H. L. Doolittle, chief engineer. The writer is especially indebted to the latter gentleman for the information in this article and to G. H. Bishop, the company's official photographer, for the pictures that illustrate it.

TABULATION OF ENGINEERING DETAILS.
First Unit of Long Beach Plant of Southern California Edison Company.

Generator	General Electric 15 000 k.v.a., 50 cycle, 11,000 volts.
Prime Mover	Vertical Curtis Turbine .
Boilers	Eight Stirling Water Tube, 7775 sq. ft. heating surface each, 225 lb. pressure, 125 degrees superheat.
Superheater	B. & W. U. type, 125 degrees superheat.
High Pressure Pipe	Van Stone Joints—Cast Steel Fittings and Valves—Welded Nozzles.
Fuel	Crude Oil in Hammel Burners, with Moore Automatic Regulating System.
Stack	Reinforced Concrete, 150 ft. high, 12 ft. 6 in. top diameter.
Exciter	Four Pole, G. E., 125 volt, 125 kw., driven by Horizontal Curtis Turbine.
Circulating Pump	30 in. Krogh Centrifugal, driven by 14 x 18 Harrisburg Engine.
Condensers	16,000 sq. ft. Wheeler Dry Tube in turbine base. 5,500 sq. ft. Wheeler Dry Tube Auxiliary.

TRANSMISSION.

Voltage	30,000 and 60,000.
Transformers	Six, G. E. 2000 kw. each, Y and delta-connected.
Bus-Bar	Extra Heavy Copper Tubing 2½ in. for 11,000 volt, 1¼ in. for 30,000 volt, and 1 in. for 60,000 volt.
Oil Switches	Type H-3 and K-12.
Lightning Protectors	Aluminum Cell Arresters for 30,000 v. and 60,000 v. Multiplex Arresters for 11,000 v.

PRIMER OF APPLIED THERMODYNAMICS.[1]
NINTH LECTURE.

Chimney Draft and Design.

In previous lectures we have found that fuels give up their latent heat when brought in contact with oxygen in such a way that combustion takes place. The resulting chemical reactions must be gotten rid of in order to keep a fresh supply of oxygen for continuing the generation of heat and thus maintaining a continuous operation of the power plant. It is evident then that the chimney which performs this function must not only have height in order to produce the necessary draft, but it must also have width, or rather cross-sectional area, sufficient to carry the volume of gas necessary in combustion. We shall find in the course of this lecture that the draft of a chimney is computed theoretically by figuring the weight of a column of heated gas in the chimney and a weight of a similar column of air without. Since the heated gas within is lighter than the cooler air without, although at the

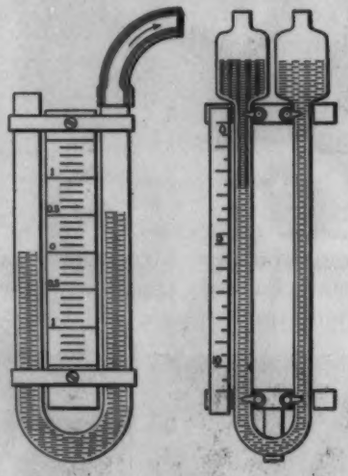

Fig. Barrus Simple and Compound Chimney Draft Gauges.

same temperature, due to ingredients of combustion being added, the condition would be reversed, the difference between these two weights will give us the theoretical draft or tendency of the cooler heavier air to drive up the chimney the heated gases of combustion. A practical measurement of this draft can be ascertained by closing the ash box doors and inserting a so-called draft or water column immediately in the rear of the combustion chamber at the lower end of the stack. Such a draft or water column is shown in Fig. 21. The heavier air without forces the column of water upward so that the weight of water level difference added to the weight of the gas within will just balance the weight of the air without. In practice this draft measurement is given in inches of water. In order to convert this into lb. per sq. in. it is necessary to multiply the draft in inches of water by the weight of a cubic inch of water which is 0.036.

Let us now derive the thermodynamic equations necessary for a theoretic discussion of mechanical draft. In a previous lecture we found that pressure,

[1]A resume', devoid of higher mathematics, covering the essentials of a series of lectures now being given by the editor of this Journal before the Senior Mechanical Engineering students at the University of California.

volume, and temperature in a perfect gas such as air, were related to each other in such a manner that the product of pressure and volume was always equal to the product of a constant and the absolute temperature of the gas, or in mathematical symbols,

$$p\,v = R\,T, \text{ which for air is } p\,v = 53.37\,T.$$

We also found that the weight of a gas could be computed from the formula

$$W = \frac{p\,V}{R\,T}$$

and that the quantity R for any perfect gas other than air could be computed, as it is inversely proportional to the densities of the two gases. In the case of combustion every lb. of fuel requires—say n lb. of air to form (n + 1) lb. of chimney gases. Hence

R for the chimney gases is $\left(\frac{n}{n+1}\right)$ times the R for air.

Hence the weight of a column of chimney gas 1 sq. ft. in cross-section and H ft. in height is

$$W_1 = \frac{p \cdot H}{53.37\left(\frac{n}{n+1}\right) T_1}$$

And the weight of an equal column of air without which is to force the hot gas up the chimney is

$$W_2 = \frac{p \cdot H}{53.37\ T_2}$$

Where p is atmospheric pressure in lbs. per sq. ft., H the height of the chimney, T_1 the absolute temperature of the chimney gases, and T_2 the absolute temperature of the air without. Therefore the draft in the chimney, or

$$\text{difference of pressure per sq. ft.} = \frac{p\,H}{53.37\ T_2} - \frac{p \cdot H}{53.37\left(\frac{n}{n+1}\right) T_1}$$

$$= \frac{p \cdot H}{53.37}\left(\frac{1}{T_2} - \frac{1}{\left(\frac{n}{n+1}\right) T_1}\right)$$

Hence the draft in inches of water is computed by reducing the pressure first to lb. per sq. in. and then multiplying by the factor 0.036 given above.

$$\text{Draft in inches of water} = \frac{p\,H \times 144 \times 12}{53.37 \times 62.3}\left(\frac{1}{T_2} - \frac{1}{\left(\frac{n}{n+1}\right) T_1}\right)$$

$$D = 0.52\ H \cdot P\left(\frac{1}{T_2} - \frac{1}{\left(\frac{n}{n+1}\right) T_1}\right)$$

By a close examination, it will be seen for practical purposes, since the quantity n is from 18 to 50,

in practice the fraction $\frac{n}{n+1}$ may be considered unity without appreciable errors. The atmospheric temperature is usually 60° F. and that of the chimney gases 500° F., atmospheric pressure 14.7 lb. per sq. in. For a chimney 100 ft. high then, we would compute the draft as follows,

$$D = 0.52 \times 100 \times 14.7\left(\frac{1}{459.4 + 60} - \frac{1}{459.4 + 500}\right)$$

$$= 0.67 \text{ ins. of water.}$$

Since this draft is computed for a stack 100 ft. high, the draft for any other height follows by an easy proportion.

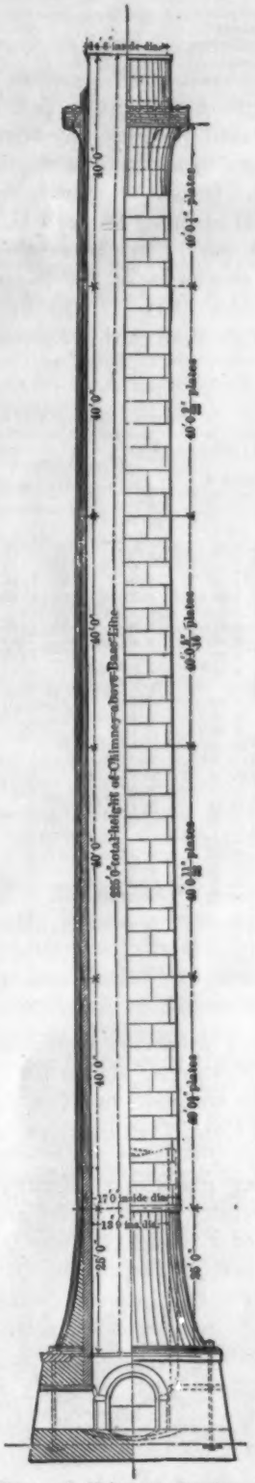

Fig. 22. Type of Chimney Design Favored by Babcock & Wilcox Engineers.

Experience shows that the draft pressure, measured in inches of water as compared with atmospheric pressure, should be from 0.5 to 1.5 inches, depending upon the character and size of the fuel to be used, and upon the quantity to be burned per square foot of grate surface. Heights above the grate, which have given satisfactory results in practice with plants of moder-

ate capacity employing different fuels, are given in the following table:

Fuel.	Height in feet.
Crude Petroleum	80 to 100
Free-burning bituminous	80
Anthracite, large sizes	100
Slow-burning bituminous	120
Anthracite buckwheat	150
Anthracite slack	175

On the Pacific Coast crude petroleum is largely used as fuel. In coal burning, anywhere from 35 to 70 per cent of the total draft head is required to overcome the friction of the fuel bed. Now chimney tables are computed for coal burning on the basis of 5 lb. of fuel per boiler horsepower. In the case of oil burning, if we compute on the basis of 2½ lb. per boiler horsepower and consider that oil can be burned with a smaller excess of air than coal, we have virtually 2 to 1, and the stack area would be sufficient for double the horsepower. In designing stacks for crude petroleum, it can be taken as standard practice that fifty per cent of stack areas of Kent's tables given above are ample for fuel oil.

Chimneys are constructed of steel, reinforced concrete, or masonry. Steel chimneys weigh less, cost less, require less space, expose less surface to the wind than other forms, and are more efficient because they are air tight. They, however, depreciate more rapidly because of rust, and because of the corrosive influence of the flue gases.

We shall next consider the necessary corrections to be made in the dimensions of proposed chimneys in their relation to altitude above the sea. All chimney dimensions and tables have been computed on the basis of sea-level pressures. From our equation of draft readings derived in this lecture, it is seen that the draft depends directly upon the pressure. Hence it is evident that since the higher the altitude, the less the pressure, the stack must be lengthened in proportion to the barometric readings. Thus if H is the proper height of a chimney at sea-level or barometric pressure P_0, then H_1 the proper height at the altitude P_1 above sea-level is as follows:

$$\frac{H_1}{H} = \frac{P_0}{P_1}$$

or if r is a factor gotten by dividing the barometric reading at sea level by the barometric reading at the proposed point of installation, $H_1 = r\,H$. The next point to consider is how the altitude will affect the cross-sectional area. At high altitudes the air becomes less dense, hence the area should be larger in order to pass the required weight of air needed in combustion of the fuel, for the same weight of air is needed for proper fuel combustion, no matter what the altitude may be.

In the flow of gases through pipes, it has been found that the weight passing any given section per minute is

$$W = K\left(\frac{p\,D\,d^5}{\left(1+\frac{3.6}{d}\right)L}\right)^{1/2}$$

Size of Chimneys for Steam-boilers.

Formula, H.P. = $3.33\,(A - 0.6\sqrt{A})\sqrt{H}$. (Assuming 1 H.P. = 5 lbs. of coal burned per hour.)

Diam. inches.	Area A. sq. ft.	Effective Area. $E = A - 0.6\sqrt{A}$ sq. ft.	Height of Chimney.														Equivalent Square Chimney. Side of Square $\sqrt{E} + 4$ ins.
			50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	125 ft.	150 ft.	175 ft.	200 ft.	225 ft.	250 ft.	300 ft.	
			Commercial Horse-power of Boiler.														
18	1.77	0.97	23	25	27	29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16
21	2.41	1.47	35	38	41	44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	19
24	3.14	2.08	49	54	58	62	66	.....	.....	.....	.....	.....	.....	.....	.....	.....	22
27	3.98	2.78	65	72	78	83	88	.....	.....	.....	.....	.....	.....	.....	.....	.....	24
30	4.91	3.58	84	92	100	107	113	119	.....	.....	.....	.....	.....	.....	.....	.....	27
33	5.94	4.48	.....	115	125	133	141	149	156	.....	.....	.....	.....	.....	.....	.....	30
36	7.07	5.47	.....	141	152	163	173	182	191	204	.....	.....	.....	.....	.....	.....	32
39	8.30	6.57	.....	.....	183	196	208	219	229	245	268	.....	.....	.....	.....	.....	35
42	9.62	7.76	.....	.....	216	231	245	258	271	289	316	342	.....	.....	.....	.....	38
48	12.57	10.44	.....	.....	.....	311	330	348	365	389	426	460	492	.....	.....	.....	43
54	15.90	13.51	.....	.....	.....	.....	427	449	472	503	551	595	636	675	.....	.....	48
60	19.64	16.98	.....	.....	.....	.....	536	565	593	632	692	748	800	848	894	.....	54
66	23.76	20.83	.....	.....	.....	.....	.....	694	728	776	849	918	981	1040	1097	1201	59
72	28.27	25.08	.....	.....	.....	.....	.....	835	876	934	1023	1105	1181	1253	1320	1447	64
78	33.18	29.73	.....	.....	.....	.....	.....	.....	1038	1107	1212	1310	1400	1485	1565	1715	70
84	38.48	34.76	.....	.....	.....	.....	.....	.....	1214	1294	1418	1531	1637	1736	1830	2005	75
90	44.18	40.19	.....	.....	.....	.....	.....	.....	.....	1496	1639	1770	1893	2008	2116	2318	80
96	50.27	46.01	.....	.....	.....	.....	.....	.....	.....	1712	1876	2027	2167	2298	2423	2654	86
102	56.75	52.23	.....	.....	.....	.....	.....	.....	.....	1944	2130	2300	2459	2609	2750	3012	91
108	63.62	58.83	.....	.....	.....	.....	.....	.....	.....	2090	2399	2592	2771	2939	3098	3393	96
114	70.88	65.83	.....	.....	.....	.....	.....	.....	.....	.....	2685	2900	3100	3288	3466	3797	101
120	78.54	73.22	.....	.....	.....	.....	.....	.....	.....	.....	2986	3226	3448	3657	3855	4223	107
132	95.03	89.18	.....	.....	.....	.....	.....	.....	.....	.....	3637	3929	4200	4455	4696	5144	117
144	113.10	106.72	.....	.....	.....	.....	.....	.....	.....	.....	4352	4701	5026	5331	5618	6155	128

The ascending gases in a chimney are retarded by friction in the vicinity of the walls, and the equivalent cross section A of a round chimney is, therefore, generally taken as that corresponding to a diameter four inches less than the real internal diameter of the chimney. Professor Samuel Sheldon states that, assuming a coal consumption of five lb. per horsepower hour, a chimney of height h feet, properly to carry off the gases from boilers of P horsepower, should have an equivalent cross section of

$$A = \frac{0.3\ P}{\sqrt{h}} \text{ square feet.}$$

William Kent has worked out formulas for chimney design which are largely used in practice and are found in the following table. With the corrections noted above for rude oil petroleum, proper chimney areas for Pacific Coast practice in burning oil can be picked at once from this table.

Where

K = a constant.
p = difference in pressure between two ends of pipe.
D = density.
d = diameter of pipe.
L = length of pipe.

In applying this formula to gases flowing up a stack, the quantity $(1+\frac{3.6}{d})$ is practically unity, the quantity L becomes equal to H and H_1 in the respective cases, and p is the same in each case. Hence we have

$$W = K\left(\frac{p D d^5}{H}\right)^{1/2} \text{ and } W_1 = K\left(\frac{p D_1 d_1^5}{H_1}\right)^{1/2}$$

But W must equal W_1 for fuel burning. Hence

$$K\left(\frac{p D d^5}{H}\right)^{1/2} = K\left(\frac{p D_1 d_1^5}{H_1}\right)^{1/2}$$

Also

$$\frac{D}{D_1} = r, \text{ and } \frac{H_1}{H} = r;$$

Therefore, substituting and cancelling

$$\frac{D d^5}{H} = \frac{D_1 d_1^5}{H_1}$$

$$\frac{r D_1 d^5}{H} = \frac{D_1 d_1^5}{r H}$$

$$r^2 d^5 = d_1^5 \therefore d_1 = d\, r^{2/5}$$

Hence in the design of a chimney at any altitude, first pick out dimensions for sea-level. Having found the proper height and diameter for sea level, the new height and diameter are found by the following rule. The quantity r is determined by dividing the barometric reading at sea-level by the barometric reading at the point of installation. Then multiply the height by r and the diameter by $r^{2/5}$, and the resulting height and diameter will be correct for the new altitude.

Sometimes short chimneys are used in connection with mechanical draft apparatus, consisting of either an exhaust fan in the smoke flue or a mechanical or steam-jet blower underneath the grate bars. An induced draft is produced by the former, and a forced draft by the latter. The advisability of installing mechanical draft apparatus is dependent upon the results of an economical comparison with the saving resulting from the lessened necessary height of the chimney, or the saving acquired by installation of an economizer which reduces the temperature so low that the draft is naturally lessened.

THERMOTWISTERS.

1. A stack is 125 ft. high. The flue gases have a temperature of 475° F., and the outside air is at 60° F., atmospheric pressure being 14.7 lb. sq. in. How many inches of water will the draft gauge read?

2. It is desired to design a stack to burn anthracite buckwheat coal to accommodate 2000 boiler horsepower. What are the proper dimensions at sea-level?

3. The above power plant is located at an altitude of 5000 ft. above sea-level and crude petroleum is to be burned. What are the proper dimensions?

SOLUTION OF THERMOTWISTERS—SIXTH LECTURE.

1. In the test of the Parker boiler found elsewhere in these columns during a ten-hour run 180,240 lb. of water were evaporated from a feed water temperature of 123.4° F. to superheated steam at 561.2° F., the boiler pressure being 179.7 lb. per in. (gauge). What is the factor of evaporation?

The total heat of superheated steam is from page 333.

$$H = 1150.4 + 0.3745\ (t-212) - 0.00055\ (t-212)^2 + k\ (T-t)$$

From table on Mean Specific Heat, page 333, I find k = 0.55
From table on page 330, I find t = 379.°5 for 179.7 lb. (gauge)
Heat of feed-water at 123.4° = 91.4

$$\therefore H = 1150.4 + 0.3745\ (379.5-212) - 0.00055\ (379.5-212)^2 + 0.55\ (561.2-379.5) = 1150.4 + 62.8 - 15.4 + 100 = 1298.0$$

$$\text{Hence factor of evaporation} = \frac{1298-h}{970.4} = \frac{1298-91.4}{970.4}$$

$$= 1.244. \text{ Ans.}$$

2. From the data given in problem 1, compute the horsepower rating of the boiler.

Since 180,240 lb. are evaporated in 10 hr. in 1 hr., boiler will evaporate 18,024 lb. Hence it will evaporate from and at 212° F.

$$18{,}024 \times 1.244 = 22{,}420 \text{ lb.}$$

$$\text{Hence H.P.} = \frac{22{,}420}{34.5} = 650. \text{ Ans.}$$

3. During the same test mentioned in problem 1, 14,093 lb. of oil were consumed. The oil has 0.6% water. The calorific value of the dry oil per lb. is 18,681 B.t.u. by analysis, show that the efficiency of the boiler was 82.13% under the test referred to.

14,093 lb. of oil containing 0.6% water is equal to $14{,}093 \times 99.4$

$$= 14{,}008 \text{ lb. dry oil.}$$

Since 1 lb. = 18,681 B.t.u. by analysis.
Total heat given out by fuel is

$$\frac{14{,}008 \times 18{,}681}{10} = 26{,}160{,}000 \text{ B.t.u. per hr.}$$

Since from ex. 1 we find 18,024 lb. of water evaporated per hr., each lb. representing (1298 — 91.4) B.t.u. Hence boiler efficiency is

$$\frac{18{,}024 \times 1206.6}{26{,}160{,}000} = 83.2\%. \text{ Ans.}$$

4. A pressure gauge reads 179.7 lb. per sq. in. What is the temperature of the saturated steam in the boiler. Compute by the empirical formula given above.

From page 333 we find

$$t = 200\ p^{1/4} - 101.$$

Substituting for pres. of 179.7 lb. gauge or 194.4 abs., we have

$$t = 200\ (194.4)^{1/4} - 101$$

$$^1/_4 \log 194.4 = {}^1/_4 \text{ of } 2.288696 = 0.381282$$

$$\therefore (194.4)^{\frac{1}{4}} = 2.406$$

$$\therefore t = 200 \times 2.406 - 101 = 481.2 - 101 = 380.2. \text{ Ans.}$$

From Steam Tables t = 379.5.

INTERURBAN ELECTRIC LINES IN SPAIN.

Great activity is also shown at present in Spain in electric railway construction. The first part of the interurban line from San Sebastian to Tolosa (Guipuzcoa), consisting of the section from San Sebastian, via Anorga, Lazarte, and Oria, to Andoain, was recently opened, the cars running the nine miles in about 45 minutes. The power equipment at Andoain consists of a motor and dynamo of 260 horsepower, and maintains a continuous current of 600 volts to the terminus of the line at Venta Berri. The power is supplied by the Hidroelectric Iberica from waterfalls at Leizaran. Work is being rushed on the remainder of the line to Tolosa and it will be ready at the end of the year.

Work will soon be begun on the proposed line from Renteria to the French frontier, and the San Sebastian-Pasajes-Renteria line will construct a branch to Venta Berri. When these lines are thus connected a through service from Tolosa to the frontier will be established. Another line from San Sebastian to Irun, via Loyola and Pasajes, will soon be opened. A concession for the construction of a 10-mile electric railway from Parrino to Vigo, Province of Pontevedra, has been awarded to the Sociedad Iberia Concessions de Bilbao, of Bilbao. Two concessions for extensions of the Barcelona street railways and one for the Madrid city lines have also been recently awarded.

NAVIGATION THROUGH THE SUEZ CANAL.

Statistics regarding navigation through the Suez Canal are of intense interest to Pacific Coast enterprise at present due to agitation in the fixing of rates for the Panama Canal. The following is compiled from official British statistics:

The total number of passengers carried through the Suez Canal in 1910 reached 233,978, as compared with 213,121 in 1909. Of the number carried last year, those classified as military totaled 76,854, while the civilians numbered 128,171, and the pilgrims, emigrants and convicts 28,953. The following table shows the volume of shipping through the canal by flag, number of vessels, and net tonnage, including merchant vessels, mail steamers, war ships, etc.:

	1909		1910	
Flag.	Vessels.	Net tonnage.	Vessels.	Net tonnage.
United Kingdom	2,561	9,592,387	2,778	10,423,610
Germany	600	2,381,681	636	2,563,749
Netherlands	251	800,950	259	854,561
France	231	802,100	240	833,099
Austria--Hungary	148	519,772	191	642,826
Italy	90	207 958	87	218,322
Japan	76	357,613	72	350,937
Russia	74	221,748	103	288,165
United States	[1]30	105,792	[2]8	8,996
All other countries	178	417,525	160	397,633
Total	4,239	15,407,527	4,533	16,581,898

[1] Including 27 war ships, tonnage 103,324.
[2] Including 4 war ships, tonnage 5,851.

Of the total tonnage for 1910, that of merchant vessels totaled 11,816,945 tons, mail steamers 3,990,817 tons, war ships 112,846 tons, Government-chartered vessels 158,097, and vessels in ballast 503,193 tons.

PRODUCTION OF PIG IRON BY ELECTRICITY

Consular reports from Sweden give some interesting figures on the production of pig iron by electricity.

The manufacturers of the electric furnace used in the co-operative experiments at Trollhattan state that the number of kilowatt hours required for the production of 1 metric ton of pig iron is, of course, higher for the poorer than for the richer ores. The following approximate figures are given as an average (metric ton = 2,204.6 pounds): For reduction of ore of 60 per cent iron content, 2,100 to 2,200 kilowatt hours per metric ton; 55 per cent iron content, 2,200 to 2,300 kilowatt hours per ton; 50 per cent iron content, 2,350 to 2,450 kilowatt hours per ton.

The quality, by weight, of carbon electrodes consumed in the production of 1 ton of pig iron has been ascertained to be about 10 kilos gross (including the electrode butts, which can not be used), but 5.27 kilos net (kilo = 2.2 pounds). With the round electrodes, capable of being connected with a scarf joint, now used at Trollhattan, the gross consumption will probably be about 6 kilos.

The consumption of charcoal varies from 20 to 23 hectoliters (57 to 65 bushels) per ton of pig iron, the lower figure being for iron containing little carbon and the higher for gray iron. For coke, which may be used to the same advantage as charcoal, the consumption should be calculated at 320 to 360 kilos.

At a furnace of 2500 horsepower, 10 hours of labor are required per ton of pig iron, but if the furnace is larger, for instance 3500 horsepower, or if several furnaces are worked at the same time, the labor hours can be reduced to seven or eight. The furnace at Trollhattan has required about 5 per cent of the working time for repairs and stoppages for exchange of electrodes, etc. In newly built furnaces this can probably be reduced. The content of iron in the slag has varied from 1 to 5 per cent, which has corresponded to a loss of ¼ to 2 per cent of iron per ton of pig iron.

QUANTITY OF CRUDE OIL AND OF PRINCIPAL PRODUCTS.

The number of 42-gallon barrels of crude petroleum used, as reported in 1909, was 120,775,439, and in 1904, 66,982,862, an increase of 53,792,577 barrels, or 80 per cent.

The kinds of crude oil used in 1909 were distributed in very different proportions from those in 1904. This change has materially affected the relative quantities of the various products.

The number of 50-gallon barrels of illuminating oils produced was 38,468,494 in 1909 and 27,135,094 in 1904, an increase of 11,333,400 barrels, or 42 per cent; of fuel oils, 34,034,577 in 1909 and 7,209,428 in 1904, an increase of 26,825,149 barrels, or 372 per cent; of lubricating oils, 10,745,885 in 1909 and 6,298,-251 in 1904, an increase of 4,447,634 barrels, or 71 per cent; of lubricating and other greases, 138,302 in 1909 and 202,439 in 1904, a decrease of 64,137 barrels, or 32 per cent; of naphtha and gasoline, 11,903,159 in 1909 and 5,811,289 in 1904, an increase of 6,091,870 barrels, or 105 per cent; and of paraffin wax, 946,830 in 1909 and 794,068 in 1904, an increase of 152,762 barrels, or 19 per cent.

LATEST TRIUMPH OF ELECTRICITY.

The Electrical Engineer of London details an interesting account of the latest triumph of the electrical art among the far-off Brahmans. Famous Hindu pundets have sat in solemn conclave at Calcutta to determine whether the sanctity of the famous Temple of Kali would be imperilled by the introduction therein of electric light, and after numerous sessions, during which with scholarly thoroughness the whole question was debated from every point of view, pundets and priests have decided with complete unanimity that the ions will carry with them no contaminating influence. So Kali-Ma, oldest and most potent of goddesses in the Hindu Pantheon, will in future be worshipped in the light of the twentieth century, and the mysterious twilight in which she has dwelt for so many centuries will be dissipated by metal filament lamps.

AN EXPERIENCE WHICH PRODUCES A SMILE.

The following experience was related at the Pacific Coast Gas Association Oakland Convention:

A demand was made on the office of a gas company for the installation of a gas meter. The office requested the usual deposit of five dollars from the prospective consumer, who instantly refused the payment of same.

There appears to be a law that meters must be set on request, within a certain time. The company

was quite unwilling to open an account with this party unless some guarantee of payment was given, as he was known to be evasive and indifferent to collectors. The party had demanded a meter in writing, so it seemed up to the company. A prepayment meter was set. Then the party took up the question of payment in advance, and held that we could not collect until after the goods were delivered. It now looked like our party had it on us; but not quite. for the prepay was left connected and the company dropped in the first quarter, thus giving the party 25 cents worth of gas. Our party found no legal objection to this method of service.

NILE SUDD AS FUEL.

As a result of the experiments which have been carried on in Europe and the Sudan during the last three or four years, says the Egyptian Gazette, the Sudan Government has definitely granted a concession, conferring a monopoly for the manufacture of solid fuel from sudd for 17 years. The government is to receive 10 per cent rebate on all fuel supplied at the price charged to public consumers. The government is further to receive a dead rent of $1,250 pr annum, or a commission of 5 per cent on the net profits of the company, whichever shall be the greater. The government has allocated to the concessionaires the first 150 kilometers (93 miles) of the Bthr el Gebel, starting from Lake No, in which they are to have the sole right of cutting papyrus, um-soof, and other aquatic growth constituting what is commonly known as sudd. The government further gives a site of 25 acres for the purpose of erecting a factory, etc., in any place which may be selected by the concessionaires, where such land may be available. The concession provides that the concessionaires shall supply the needs of all government services in preference to private consumers, and stipulates for a minimum output of 25,000 tons per annum. It is understood that the plant to be put down is to have an output of double that amount.

WORK OF RECLAMATION SERVICE.

Progress has been rapid and the activities of the bureau have been extended to 28 projects, which to date involve the expenditure of approximately $59,580,000 in the United States proper.

In the eight years of its work the service has built 5967 miles of canals, many of which carry whole rivers. It has excavated 19 miles of tunnels and built 24,235 canal structures and 2,193 bridges. It has completed three of the highest dams in the world. Its excavations of rock and earth amount to the enormous total of 73,666,000 cubic yards. Its roads have a total length of 570 miles; telephones, 1,694 miles; levees, 75 miles. It has purchased 905,682 barrels of cement and has manufactured in its own mill 340,000 barrels.

As a result of its work water is available for 1,086,000 acres of land. The gross value of crops produced on the lands irrigated by the Government projects in 1910 was $20,000,000. As a result of the work of the Government it is estimated that land values have increased more than $105,800,000.

Approximately 14,000 families are now residing on farms which are being watered by the Government canals. Not less than 25,000 people have been added to the population of the cities, towns, and villages as a direct result of the Government work.

COMPRESSED AIR IN MINES OF BUTTE..

According to facts recently published, the copper mines of Butte, Montana, are to-day producing copper cheaper than at any time in their history. This has been brought about by the introduction of many economies in operation.

Compressed air in the hoisting operations, electricity being the power employed, has made a material reduction in costs; while electric haulage underground and the substitution of electric power for steam in the operation of the pumps, has effected other savings. The saving effected in this way, as against steam, has been placed by local authorities at thirty-five per cent, some have placed it even higher.

ELECTRICAL ENTERPRISE IN ARGENTINA.

An engineer named Edwards has asked the Federal Senate to grant him a concession for constructing various cable railways in various parts of Argentina from Buenos Ayres to Rio Negro and from Patagones to Ente Rios. The concession is to comprise many subsidiary undertakings, including the generation and supply of electric power and the construction of grain elevators on the bank of the River Plata. The petitioner agrees to sign the contract for the construction of the work within six months from the date on which the law authorizing it is promulgated.

POWER RATES FOR PUMPING.

Word is received from Southern California that the Southern California Edison Company has revised its rates for pumping since the opening up of their new Long Beach plant. From midnight to 6:00 a. m. at the municipal pumping stations, the rate will be one cent per kilowatt hour; from 6:00 a. m. to 5:00 p. m. 1.33 cents per kilowatt-hour, this rate also being in force from 9:00 p. m. to midnight; from 5:00 p. m. to 9:00 p. m. two cents per kilowatt hour.

BIDS FOR MANILA GAS FRANCHISE.

Advertisements for bids for the gas franchise for the city of Manila were issued on September 16. Tenders will be received until December 18, 1911. A copy of the Philippine law providing for the granting of the gas franchise, as passed by the legislature at Manila, has been received by the Bureau of Manufactures, and will be loaned to interested firms. The franchise is for 50 years.

COMMERCIAL WOODS OF THE UNITED STATES.

The second series of this interesting group of investigations has just been published by the Forest Service. The bulletin, which is No. 99 of the U. S. Department of Agriculture covers the study of pines.

A WESTERN HIGH PRESSURE PLANT.

A hydroelectric plant which is to be constructed for the municipality of Penticton, B. C., will operate under a static head of 2115 feet, the effective head being computed as something over 2000 ft.

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Where to Buy it in the West

Someone has said that old Jonah, as he was taking his aerial journey shoreward must have sarcastically remarked to the whale: "Well, old fellow, you can't keep a good man down." And so it is in the West with enterprise born or boosted on the Pacific Slope. The aggressive spirit there engendered cannot be downed.

A new country is made by the cooperation of its citizens. As the secondary coils of the transformer throb and breathe with the quivering life-giving energies that pulsate from the primary coils, so our industries—nay even our very material prosperity and happiness pulsate and throb with the nurture and nourishment of western spirit. "Hang together or hang separately," though a motto of the highwayman of vigilante days, has even a stronger, fuller meaning in the new era now before the West.

Some issues back the Journal started a listing in its columns of "Where to Buy It in the West." The listing is intended to detail the local houses throughout the West where various classifications of standard specialties may be obtained. The spontaneous and whole-souled support with which our efforts have been met is certainly indicative of the fact that the heart-string of the west has been reached in the satisfaction of a long felt want.

While engineers come and engineers go, and commissions still figure Depreciation we want at this time to expess our heartfelt Appreciation.

Power Plant Visitation

The larger manufacturing concerns with their power plants in educational centers, have of late fairly swarmed with engineering students from Western universities. The idea is a capital one. It gives the student an enlarged vision of the engineering world, clinches discussion taken up in the lecture room, and incidentally gives the power plant operator a taste of the student side of engineering life not the least part of which is the impression of amazement left in the operator's mind as to how one small human brain can contrive so many questions in so brief a period of time.

The question of visitation is important, however, not alone to the university student. The professional engineer who crawls into his shell day in and day out, neglecting to see the progress in design made by his competitors, is liable some day to be left behind in the onward progress of events, and though he may stoically declare, as does the lost Montana Flathead—"Injun no lost, tepee lost"— he will awaken some day to find that the world at large considers him in the class of yesterday.

The interesting part of engineering life is that ideas and designs, like fashions, are constantly changing. Mental and material junk, composed largely of the most brilliant ideas and design of yesterday, are today heaping high. The difference between the engineer and his brother laborer who pushes the truck back and forth in unloading the cargo, is that, while both find exquisite enjoyment in the "continual round of pleasure" involved, the round of pleasure of the

engineer does not necessitate such a literal interpretation, but daily—yes, even hourly—changes to new field of endeavor and experiences.

The Call of the Engineer

In the early classification of the various engineering professions, but two distinct branches were recognized, and the expert so engaged was known as either a military or civil engineer. In fact, going still further back into ancient history, we find only one classification, and usually the engineeer of ancient times was known simply as a mathematician. Hundreds of years before the Christian era, the city of Syracuse put up its stubborn defense covering years of siege by an obstinate enemy. Upon closer examination into the reasons as to how a city could withstand the long period of onslaught by apparently overwhelming odds, we find that it was due to the brains and design of that ancient giant mathematician, Archimedes, who playfully announced that he could, with his levers, move the whole universe if he could only find a place upon which he could rest them.

When, in spite of the powerful stone-hurling machines that he had invented, the enemy, after years of siege, finally in triumph entered the fallen city, Archimedes was found drawing his designs in the sand. Furthermore, history tells us that he wrathfully resented, perhaps in words bordering on modern forceful engineering vocabulary, the interference of a soldier, who interrupted the working out of these designs. We can imagine that every scornful, browbeating expression of the modern chief draftsman was made use of by this ancient designer in ordering the intruder not to "disturb his circles.."

Be this as it may, the incident is instructive to those who are studying the progress of the engineering profession. This early idea that the engineer is first of all a mathematician, then a recluse designer, is on the verge of a transformation so complete, so revolutionary, that young engineers, entertaining a future career in their profession and dreaming along lines of former views of what a career leads to, had better explode a keg of dynamite and wake up, or theirs will be the field occupied by the hundred dollar-a-month men, and perhaps some day some apparently rough soldier brother, who has early recognized the higher plane to be attained in the profession, may come along, "disturb the circles," cut off his head, and put a more aggressive chap in the place so long occupied.

In a word, the call of the engineer for the future is broader than that of the mere mathematician, designer, or operator. Our entire country is awakening to new ideas of property rights and property interests. New ideas as to what are just and proper relations to be maintained between the great public service corporations on the one hand and the people on the other. New ideas as to how rates are to be made, appraisements computed, and even new ideas as to how the corporations should run their own business affairs. Throughout the ages the man who has been put in such a position that it is his function to deal out justice to his fellow men has been universally recognized as occupying the highest calling within the gift of his fellows. Such a calling is so high, so broad, and so humanitarian, no other profession is worthy to touch the hem of its garment.

California, Washington, Oregon, Utah and Nevada have reecntly passed several constitutional amendments, which put the very life and well-being of her public service corporations into the hands of the State Railroad Commissioners. It requires little stretch of imagination to come to the conclusion that in the not-far-distant future, practically every corporation, whether serving the public in the way of furnishing water, heat, electricity, transportation, or engaged in furnishing the great supplies of foodstuffs, such as coffee, sugar, flour, and the like will be under the rigid inspection and control of government commissions.

The question then arises as to who is to be the educated, fearless, justice-giving personage that is to deal out carefully balanced decrees to all sides of the impending controversies. The lawyer certainly can not do it, for while his high strung, sensitive instincts pick technicalities and refined meanings of man-made statutes as quickly as the armature of the motor responds to the current-enlivened magnetic field, he has at best only a limited knowledge of the laws that nature has made in the design of that magnetic field, and consequently can never with proper delicacy solve the commercial problems resulting from these laws. Again an accountant or auditor can not do it, for while his years of technical grinding into costs and systematic detailing and listing of every expense of maintenance and operation, hold the uninitiated spell-bound with the rapidity with which facts and figures can be handled, yet his ignorance of the great laws which go to build up the engineering industry deprive him of that delicacy in judgment required in weighing depreciation which comes alone to the engineer versed in the art through years of practice and study in his profession.

And so it is, the delicate task must be left solely to the engineer of the future. Our engineers will do well to early realize the high duties ahead. No half-baked ideas on depreciation can ever win for them the commendation of all concerned. Minerva, the goddess of Wisdom, is said to have sprung from the brain of Jupiter full-grown and full-armed, but ours must be a struggle of development. Let us, then, as engineers, put forth renewed effort to meet the high calling ahead for us, and in this educative effort, let us sprinkle a liberal seasoning of the golden rule idea, not as some would make it, "Do others, or others will do you," but rather let us learn to weigh our decisions from the inner recesses of the human heart, and the greatest triumph of any profession is in store for the new call of the engineer.

PERSONALS.

Henry L. Scott, president of the Pacific Telephone & Telegraph Company, is at New York.

A. Costas, an electrical engineer of Mill River, Oregon, visited Portland on a short business trip recently.

W. L. Goodwin, manager of the Pacific States Electric Company, has returned to San Francisco from a business trip to Los Angeles.

F. A. Nash, president of the Omaha Electric Light & Power Company, is at San Francisco on a trip covering the Pacific Coast.

P. L. Thomson, formerly manager of the Western Electric Company's Pittsburg house, has been appointed advertising manager.

F. S. Hurst, sales engineer with Pierson, Roeding & Co., has returned to San Francisco, after a month's visit to Southern California.

Mortimer Fleishacker, the well-known banker and power magnate, is again at his Western headquarters after a recent business trip through the East.

H. Bostwick, secretary to the President of the Pacific Gas & Electric Company, has returned to San Francisco after a flying trip to Honolulu, T. H.

Thomas Mirk, of Hunt, Mirk & Co., has returned to San Francisco after visiting Southern California points in connection with new contracts secured.

H. V. Carter, president of the Pacific States Electric Company, has returned from a six-day excursion through the mining districts of Northern California.

F. H. Poss, manager of the Pacific Coast department of the Holophane Company, has returned to San Francisco after a business trip to Los Angeles.

B. F. Kieruiff, Jr., of Los Angeles, is visiting the Eastern factories of the several electrical manufacturers for whom his company is the Pacific Coast representative.

Homer McNutt, manager of the San Diego Electric Railway Co., has returned to San Diego from the American Electric Railway Association convention at Atlantic City.

Robert L. Jaynes, of Pittsburg, Pa., was elected Jupiter of the Rejuvenated Sons of Jove at the annual meeting at Denver, Colorado, at the time of the Denver Electric Show.

H. A. Lardner, manager of the Pacific Coast branch of J. G. White & Co., of New York, has returned to San Francisco after spending about two months on the Atlantic Coast.

H. D. Donnell, agent for the Safety Car Heating & Lighting Company, has returned to his San Francisco office after a trip to Portland, where he found business conditions active in his lines.

J. J. Youd, electrical engineer for the Mariposa Commercial & Mining Co.'s hydro-electric plant at Bagby, California, has just completed a $10,000 repair job on the company's dam at that place.

J. B. Ingersoll, formerly electrical engineer with the Spokane & Inland Empire Railroad Co., at Spokane, Wash., is now electrical engineer with the British Columbia Electric Co., at Vanvouver, B. C.

G. R. Murphy, manager of the storage battery department Pierson Roeding & Co., left for Philadelphia October 24th to attend the annual meeting of the district sales managers for the Electric Storage Battery Company.

P. M. Downing, engineer of operation and maintenance of the Pacific Gas & Electric Company, is making a visitation of the hydroelectric plants of the system, in company with J. H. Wise, the assistant general manager.

Robert Sibley, editor of the Journal of Electricity, Power and Gas, is attending the California Municipalities League meeting at Santa Barbara, after which he will make a short visit at Los Angeles before returning north.

James Irvine, formerly Pacific Coast representative of the Central Electric Co., of Chicago, has bought a large interest in the Lorbeer Electric Supply Co., of Los Angeles, and San Francisco, making his headquarters at Los Angeles.

John M. Moran, president of the Moran Engineering Company of Seattle, has returned after a three weeks' business and pleasure trip East. Mr. Moran's itinerary included Milwaukee, Chicago, Deming, Ohio, and New York City.

Franz Kammann, a hydraulic engineer from Austria, is examining various hydro-electric plants in the West. After going through the various plants of the Washington Water Power Co., at Spokane, he left for California by way of Portland.

H. F. Wheeler has resigned as superintendent of distribution for the Spokane Falls Gas Light Co., Spokane, Wash., to become general superintendent of the gas works at Hattiburg, Miss.

A. C. Sprout has returned to his San Francisco office for a short stay, after spending several months in Northern California for the Siskiyou Electric Power & Light Company, as electrical engineer in charge of the work on the Klamath River development.

B. E. Dudley, sales manager of the Chicago office of the Lombard Governor Company, for which Pierson Roeding & Co., are Pacific Coast agents, is at San Francisco in connection with the bids on the hydro-electric plant of the Los Angeles aqueduct project.

Sidney R. Inch, manager of the Missoula Light & Power Co., is again back superintending his Montana duties after an enjoyable 60-day rejuvination abroad. Mr. Inch has not been to England, his old home, for ten years, consequently the long-looked-for treat was enjoyed to the utmost.

Alexander McAdie, professor of the U. S. Weather Service for the Western division, has added one additional factor in aiding maritime progress on the coast by sending out weather forecasts each morning at nine o'clock by wireless, which reach vessels at sea within a radius of six hundred miles.

J. B. Birdsall, assistant to the general manager, and C. E. Lane, assistant to the chief draftsman of the Union Iron Works, were the courteous guides for the recent visitation of the Mechanical and Electrical Engineering students of the University of California at the company's works in San Francisco.

Delos A. Chappell, president of the Southern Sierra Power Company, has been spending some days at San Francisco on business connected with the early construction of a 250-mile steel tower line from Bishop to San Bernardino. Power will be transmitted from a new hydro-electric plant, and a steam relay station will also be installed at the latter city.

F. X. Cleary has resigned his position as advertising manager for the Western Electric Company, to engage in special advertising and sales promotion service. Mr. Cleary's long service as salesman, sales manager, and advertising manager has given him a wide experience and acquaintanceship in the electrical field, which will continue to be his line of future effort.

Bion J. Arnold has been formally retained by the Board of Supervisors of San Francisco to investigate the local street railway lines and render a comprehensive report on the traffic situation. Mr. Arnold will receive a retainer of $2500 and $250 a day while actually at work on the city's problems, including the relief of the street car congestion and the out-

lining of the city's future street railway development. The best method for the completion of the Geary street electric railway and the laying out of a comprehensive system of municipal lines for the future will also be considered.

George L. Davis, chief engineer of the Pacific Railway & Navigation Company of Portland, with Mrs. Davis, returned recently from California, where they spent more than two months. Mr. Davis, who went away on leave of absence because of illness, has recovered his health completely and has resumed his former position. While in California Mr. and Mrs. Davis visited San Diego, Los Angeles and San Francisco.

OBITUARY.

Robert Mather, chairman of the Board of Directors of the Westing ouse Electric & Mfg Co., died at his home at New York C ty, October 24. Mr. Mather visited San Francisco last September while on a tour of the Pacific Coast.

ELECTRICAL CONTRACTORS' NOTES.

Harry Tittle, manager of the John G. Sutton electrical department, arrived from Vancouver Sunday night.

The National Electric Company have been awarded a job of wiring for Mrs. Emma Ferris, on Market street, between Fifth and Sixth.

The Butte Engineering & Electrical Company have been awarded the electrical work for the Crocker Hotel on Mission street, between Third and Fourth.

Geo. Duffield, organizer for the National Electrical Contractors' Association, has spent the past ten days in San Francisco and the vicinity, talking to the contractors about National organization.

In speaking of the California Contractors' Association he says that it is well organized and ranks with New York and Illinois, which both have large organizations. Mr. Duffield leaves for the southern part of the State Friday morning.

In company with W. S. Hanbridge, State Secretary of the California Association of Electrical Contractors, Mr. Duffield has visited San Jose, Palo Alto, Oakland, Santa Rosa, Sacramento and Stockton. He has obtained a great many new members for the National body and reports that a great deal of good work is being done in the East in getting lighting companies to cut out wiring at cost and also to better the contractors' conditions generally.

TRADE NOTES.

The Siskiyou Electric Power & Lighting Company, Yreka, Cal., has ordered from the General Electric Company three 300 kw. and two 500 kw. water cooled, and two 300 kw. oil cooled 60,000-volt transformers and a switchboard.

R. F. Oakes, president of the American Ever-Ready Battery Company, states that since additional machinery has been installed the capacity of the San Francisco factory has been increased to two carloads of batteries each day. Additional ground has been leased in the rear of the factory to provide increased floor space for manufacturing and warehouse purposes.

Hunt, Mirk & Co., who were recently awarded a contract for a complete electric power plant, to be operated with oil fuel, by the Tulare County Power Company, have just commenced work at the site of the brick power station, which will cover an area of 55x60 feet. Westinghouse-Parsons turbo generator equipment, with a capacity of 3000 horsepower, is to be installed at Tulare. This plant is to be completed next April and then a hydro-electric plant will be commenced. Artesian wells are being driven on the premises to furnish water for the water-tube boilers. F. T. Billings, who is interested in the company, estimates the total expenditure on steam plant and distributing system to reach $250,000.

MEETING NOTICE.

The correct date of the National Mine Safety Demonstration is October 30 and 31.

THE CALIFORNIA MUNICIPALITIES LEAGUE MEETING.

The following partial program of the California Municipalities League carried out during the past week at Santa Barbara is of interest to the engineering world and proved of much interest and profit to those hearing the papers and discussion.

Wednesday, October 25, 1911, 9 o'clock a. m., department of engineers, councilmen and street superintendents. "Municipal Lighting Plants," Prof. C. L. Cory, University of California. (Impromptu discussion by delegates). "Water Supplies for Small Cities," Prof. C. D. Marx, Stanford university, and president board of works of Palo Alto. (Impromptu discussion by delegates). "Purification of Water Supplies," Prof. Charles Gilman Hyde, University of California. (Impromptu discussion by delegates: "Conditions Affecting Municipal Water Plants in Central California," Frederick C. Roberts. (Impromptu discussion by delegates). "Franchise Under the New Constitutional Amendment," Percy V. Long, city attorney of San Francisco. (Impromptu discussion by delegates).

Thursday, October 26, 1911, 9 o'clock a. m., department of engineers, councilmen and street superintendents. "The Importance of Proper Sewage Disposal, With a Reference to the Imihoff Tank," C. E. Grunsky, civil engineer of San Francisco. (Impromptu discussion by the delegates). "The Use of Vitrified Sewer Pipe," Prof. Fred H. Tibbetts. (Impromptu discussion by delegates). "The Use and Value of Corrugated Iron Culverts," Chris. P. Jensen, city engineer of Fresno. (Impromptu discussion by delegates). "Disposal of Refuse in San Francisco," F. K. Blue, assistant city engineer of San Francisco. (Impromptu discussion by delegates). "Garbage Incinerators for Small Cities," Charles E. Slian, city engineer of Mill Valley. (Impromptu discussion by delegates). "The Use of Asphaltic Base Oils for Roads and Streets," Charles A. Blackmar, oil inspector of Los Angeles. (Impromptu discussion by delegates). "Oil Macadam Pavements," George N. Randie, city engineer of Sacramento. (Impromptu discussion by delegates). "Substantial Pavements for Streets and Highways," R. M. Morton, engineer of the highway commission of San Joaquin county. (Impromptu discussion by delegates).

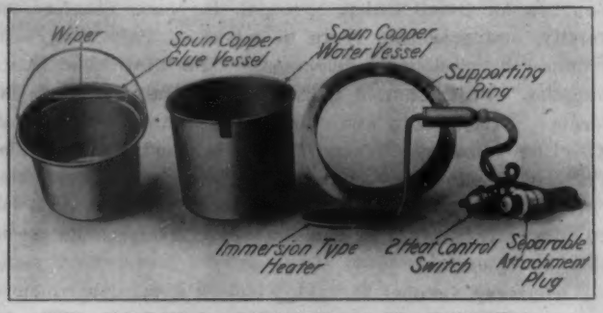
NEW TRADE PUBLICATION.

The Westinghouse Electric & Manufacturing Company has just issued the first edition of a small monthly publication entitled "Small Motors," which is devoted to forming a co-operative bond between the manufacturer and the dealer in small electric motors for general household, store, and office work. The publication is devoted to practical applications of small motors, showing views of motors in actual service, such as operating ice cream freezers, small lathes, washing machines, grinding wheels, and numerous other household devices. An interesting application of the small motor for the household is its use as an auxiliary to the furnace, assisting the heating and ventilating of same. By means of a blower attachment the motor may be used.

INDUSTRIAL

ELECTRIC GLUE HEATING APPLIANCES.

It has been authoritatively stated that more than $4,000,000 is paid every year by manufacturers in this country for glue. It has also been asserted, by those in position to know, that approximately one-half of the glue purchased, or $2,000,000 worth, is wasted yearly. Some of this waste is unavoidable, but much of it can be prevented. A great deal of glue is spoiled through over-heating. It is well recognized that the proper temperature for melting glue lies somewhere in the neighborhood of 140 degrees Fahrenheit. It is also thoroughly appreciated that, if the temperature of glue is allowed to much exceed 160 degrees Fahrenheit, if it is not rendered wholly unfit for use, its strength will be greatly impaired. An expensive glue thus abused will be no more effective than a cheap one.



Exploded View of Flush Bench Type Glue Pot.

Either live or exhaust steam has a temperature (at atmospheric pressure) of at least 212 degrees Fahrenheit. This is altogether too high for glue heating.

Electrical methods of glue heating are, when properly applied, ideal. The east with which the heat can be controlled, the evenness of the temperature afforded, the readiness with which electricity for glue pot or heater operation can be conducted to any part of a factory, and its economy are all convincing recommendations for the electrically heated appliances.

Not all electrically heated appliances give satisfactory service. Some electrical glue pots are made without water baths and it has been found that these burn glue. In other glue pots the electrical heating element is arranged in the device in such a way that only a small portion of the heat generated is usefully expended in heating glue. The rest—a large proportion—is wasted by being radiated from the heater.

The Westinghouse Electric & Manufacturing Company is manufacturing a line of glue-heating appliances that have been designed to incorporate all desirable features.

CONVENIENT MEANS FOR DETERMINING FLUE GAS TEMPERATURES.

It is an interesting fact that the melting points of metals are found to be too uncertain and evasive to be used as temperature tests. That is, it is difficult to tell the exact point at which the metal melts, since it does not change suddenly from a hard solid to a liquid, as does water, but goes through an intermediate softening stage similar to iron and many other substances. Even after the metal is completely melted, a hard skin of oxide is usually found to have been formed upon its surface, which prevents the metal running easily, and therefore is apt to confuse the determination of the exact temperature.

The Green Fuel Economizer Co., therefore, devised the expedient of using the tensile strength of the metal, instead of the melting point, as the true indication of temperature. In other words, the pendants are made with a large body, having a certain definite weight, suspended from a narrow neck, and the composition of the metal and cross section of this neck are adjusted until the body of the pendant will pull the neck in two and fall at some desired temperature.

In actual use the pendants are hung upon a small hook made upon the end of a long wire, which is introduced into the flue so that the pendant will be at the desired point. The best way is to begin with the lowest temperature pendant and proceed until the one is found which will not fall off after five or ten minutes' exposure. The temperature will then lie somewhere between the temperature marked on the last pendant and the next to the last pendant used. In doing this, it is quite essential that several different points in the flue be tried, as it very frequently happens that one part of the flue is occupied by gases much hotter than the gases in other parts of the flue.

SEPTEMBER SALES INCREASE 12%—SEPTEMBER THIS YEAR BIGGEST SEPTEMBER IN COMPANY'S HISTORY.

Western Electric experienced a most satisfactory revival in orders billed out of its factories in September. After four months of comparative declines shipments came back last month with the best increase for many a month and the largest this fiscal year. The gain was 12% ,and September sales were the largest for that month in the company's history.

For the nine months to September 30 Western Electric gross was 4% in excess of the same period last year, and a total overturn for the full twelve months of $66,000,000 is promised.

PORTLAND, GREY & LEWISTON RAILWAY COMPANY'S ELECTRIC LOCOMOTIVE.

A Baldwin-Westinghouse electric locomotive was recently purchased by the Portland, Grey & Lewiston Railway Company. The locomotive is designed by the Baldwin Company as one of Class 8-4/100, E 9. This classification indicates that there are eight wheels total and four motors per locomotive. E is a classification letter used by the Baldwin works, donating the number of driving axles. One hundred stands for the horsepower of the motors, and the 9 means that it is the ninth locomotive built of its class.

New Electric Locomotive.

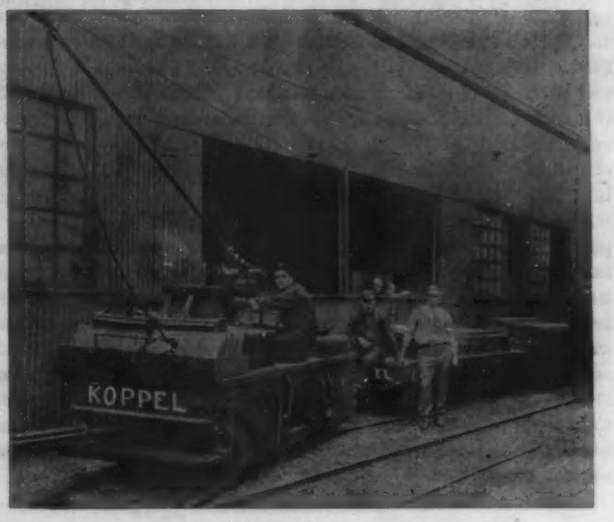
Four—No. 303-A Westinghouse motors with a gear ratio of 16 to 61 drive the locomotive and are controlled by a Westinghouse HL control equipment. A feature of HL control that was one of the determining factors in its adoption for this application is the incorporation of an ideal circuit-breaking

device in the control equipment. The line switch performs the functions of a circuitbreaker. The switch is controlled by a relay which operates whenever the current to the motors exceeds a predetermined value.

There are several breaks in series, and the arcing effect is distributed among them all, providing an effective breaking distance of several inches.

A STEEL MILL'S INDUSTRIAL RAILWAY.

The quick and economical transportation of material has long been a serious problem in many steel plants. The managers of the mills of the Superior Steel Company, in Carnegie, Pa., alive to modern improvements, have most efficiently



Electric Transportation in a Steel Mill.

solved this problem. Only recently they have completed the installation of a new system of transporting their steel and raw materials from one building to another and around the mills.

Formerly this was done by means of the time-honored trucks run over steel plates laid on the floors about the mills and hauled by men. Today they have in successful operation

Modern Improvements in Mill Transportation.

a complete industrial railway system, including electric locomotives, cars, tracks, switches, etc., enabling them to quickly and easily haul materials to all parts of their plant.

This entire equipment was furnished by the Oranstein-Arthur Koppel Company, of Pittsburg, and was built in their own plant at Koppel, Pa. The electric locomotives shown in the accompanying illustrations, which give different views of the equipment in the Superior Steel Company plant, are operated by an overhead trolley, and are easily handled by one man. By the old method of hauling it required several men to handle each truck—today one man operates a whole train.

The steel company think so well of their Koppel equipment that they have just recently ordered twenty-four additional cars. These will soon be delivered and will give the steel company ample facilities for handling all their products.

A NEW ELECTRIC CIGAR LIGHTER.

Many interesting characteristics are displayed by the heating element used in the Helion cigar lighter, now being put on the market. It has many hundred times the resistance of platinum or of nickel chronium alloys. Consequently a large amount of energy can be concentrated into a small space. A few inches will produce the same results when placed on the electric circuit as many feet of fine platinum wire.

Improved Electric Cigar Lighters.

It is capable of withstanding the enormous temperature of 1700 degrees Centigrade without change in its physical, chemical, or electrical characteristics. All danger of short circuiting due to its becoming plastic or losing its shape is eliminated.

When connected to the proper voltage this material will maintain its temperature and hold its character practically indefinitely. On account of the small amount of material it comes up to temperature very quickly. This material burns in the open air and requires no insulation of any kind.

Cigar ashes or any other foreign substance may come into contact with it without having any effect upon it whatever. Also it is not affected by moisture or by draughts of cold air.

Among the interesting experiments connected with it was one of burning it for a long period under water, where it performed exactly as when burned in the air, and showed no deterioration due to submerging.

In addition to showing great strength and its capacity to withstand such an extreme high temperature it possesses the good quality of being extremely cheap.

A 50-cent heater is guaranteed to last six months in any cigar store.

Both types are made for either A. C. or D. C. circuits and for two voltage classifications—100 to 110, and 110 to 120.

Manufactured by the Pittsburg Electric Specialties Company, No. 927 French St., Pittsburg, Pa.

NEWS NOTES

FINANCIAL.

EUGENE, ORE.—An ordinance was passed providing for the form and sale of the proposed $25,000 street lighting bonds.

LYNDEN, WASH.—The issue of $2000 additional water bonds was carried at the special election by a vote of 66 to 28. Funds are to be used for a water supply system.

MONMOUTH, ORE.—The City Council has accepted the bid of Sutherlin & Co. of Kansas City, for the issue of $25,000 bonds to be issued for the installation of the new water system. Work will be commenced as soon as contracts are let.

RIDDLE, ORE.—At a special taxpayers' election Riddle voted bonds of $15,000 for the construction of a waterworks system, the old plant being entirely inadequate; also $13,000 for construction of a complete sewer system. Both issues were carried and work will begin as soon as the contracts are let.

OAKLAND, CAL.—A $5,000,000 mortgage, given by the Union Water Company to the Anglo-California Trust Company has been recorded in the county recorder's office. The mortgage covers realty holdings of the water concern in this and other counties. The Union is a subsidiary concern of the $200,000,000 United Properties Company of California, at the head of which are F. M. Smith and W. S. Tevis. The mortgage is given in security of the company's issue of bonds.

TRACY, CAL.—A number of applications to purchase the bonds for the water and sewer system have been received. The N. W. Halsey Co. of San Francisco made an offer to buy $21,000 worth of the long time bonds and as many more of the short time bonds as they could get at par, plus attorney's and other incidental fees. The West Side Bank of Tracy offered to purchase $19,000 worth of long time bonds and as many more short time bonds as they could buy, and the Bank of Tracy presented an offer for $10,000 worth of the long time bonds, with the privilege to buy a number of the short term bonds. All offers were for par, plus incidental expenses. On motion it was decided to accept the different bids and to authorize the sale of the bonds.

RIVERSIDE, CAL.—A trust deed, involving $5,000,000 has been filed in the office of County Recorder Logan, consisting of one of the biggest documents of the kind ever filed in Riverside County. The deed conveys to the International Trust Company the property of the Southern Sierras Power Company, securing an issue of $5,000,000 first mortgage, 6 per cent, 25-year gold bonds. The Southern Sierras Power Company is the corporation which is building a transmission line from San Bernardino to Bishop, to connect with the plants of the Nevada Power Company, and which will have a big steam plant at San Bernardino. The company was represented by F. A. Worthley of this city in securing franchises. Other franchises owned by the company cover the streets and highways of both Riverside and San Bernardino counties, and of Perris and Corona in this county. These, and other franchises, together with all the other franchises, together with all the other property of the company, such as transmission lines, buildings and improvements and the entire capital stock of the Corona Gas and Electric Light Company, comprise the security for the bonds.

SAN FRANCISCO.—The stockholders of the Pacific Gas & Electric Company, at meetings held at the company's offices at San Francisco, on October 23, authorized the creation of a new mortgage upon the company's properties under which it may, from time to time, as required, issue its bonds to the maximum amount of $150,000,000. This new bond issue will provide the means for refunding or retiring at maturity, or as occasion may arise, all of the existing bond issues of the Pacific Gas & Electric Company and of subsidiary and controlled corporations. This will eventually absorb about $67,000,000 of the new issue. The remainder of the new issue, about $83,000,000, will be available for such extensions, additions, improvements, betterments, etc., as the growth of the company's business may require. During the past five years the company has expended more than $17,000,000 in enlarging and improving its service, and, assuming about the same average rate of growth in the future, the new bond issue will supply the company's needs for new capital for approximately twenty-five years. It is not the company's intention to issue any of these new bonds immediately. It is simply providing the financial facilities for meeting increased demands for its service that will inevitably arise out of the growth of the population and the multiplication of industries in Central California during the next decade, and the bonds will be issued and sold only as required from year to year to pay for this new construction. At this meeting the stockholders also approved an increase in the common stock of the company to $150,000,000, this being also the amount of the new mortgage which was authorized. The company does not contemplate the immediate issuance of any of this stock, the action of the stockholders in authorizing the increase having simply been taken to enable the company to comply with the California statute under which no California corporation may have outstanding indebtedness in excess of its subscribed capital stock.

ILLUMINATION.

ELLENSBURG, WASH.—Resolutions have been passed creating special improvement districts for the installation of street lights.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company bid in the franchise for gas mains along certain county roads in Montecito, paying $100 for a 50-year franchise.

EL CENTRO, CAL.—The Imperial Valley Gas Company is perfecting plans for the extension of its gas service throughout the south and southeast portions of El Centro. This company may also put a gas service into Brawley soon.

LOS ANGELES, CAL.—W. A. McNall & Co., of Pasadena, have placed an order with the Los Angeles Brass Mfg. Co., 711 North Main Street, which calls for 171 ornamental bronze lighting posts, to be used to beautify South Orange Grove Avenue, Pasadena.

GLENDALE, CAL.—The Glendale Light & Power Company has offered to furnish the city of Tropico with 32-candle power street lights at $1 each per month. In addition to this the city must pay the cost of installing the system and furnishing all lamp renewals.

SAN BERNARDINO, CAL.—Manager C. M. Grow of the Southern California Gas Company has announced that a sufficient number of Rialto residents have signed up for use of gas and that the construction of the line will start as soon as material is secured. This will be a high pressure system, similar to the one reaching out to Highland.

SAN RAFAEL, CAL.—The Pacific Gas & Electric Light Company has a number of men in Southern Marin securing contracts for the furnishing of gas. At present men are working in Sausalito, Corte Madera and Larkspur, with a view of signing up householders. If the required number are obtainable the company will begin at once to extend its mains to this territory. At the present time a Mill Valley company is engaged installing a gas plant in that district.

TELEPHONE AND TELEGRAPH.

ODESSA, WASH.—Representative Crandall of the Pacific Telephone & Telegraph Company has addressed the council relative to the obtaining of a telephone franchise for the company in the town of Odessa.

REEDLEY, CAL.—At a meeting of citizens held here in the office of D. L. McKeel, initial steps were taken looking to the formation of a co-operative telephone company in Reedley. A committee consisting of Lucas Keyser, T. M. Lane and Carson Reed has been appointed to take up the question.

FLORENCE, ORE.—Applications for franchises have been made by the Florence Electric Company, for light and power, and by the Florence-Mapleton Independent Telephone Company, for a telephone system. An election was held October 16 for voting these ordinances.

SANTA FE, N. M.—The Ranchers' Telephone Company has been incorporated with capital stock of $3000. The main office will be at Wagon Mound and R. K. Odell will be statutory agent. The incorporators are: R. K. Odell, S. M. Reiland and S. Foutz of Wagon Mound, J. P. Van House and A. Urbahns. The company will erect a telephone line near Wagon Mound for the convenience of ranchers.

SAN FRANCISCO, CAL.—The attempt of the City and County of San Francisco to collect $502 license tax from the Pacific Telephone & Telegraph Company failed when Superior Judge Seawell sustained the corporation's demurrer. Judge Seawell upheld the validity of the constitutional amendment relating to the separation of State and municipal taxes for public service corporations, thus making it necessary for the city to either file a new complaint or drop its suit.

INCORPORATION.

MODESTO, CAL.—The Modesto and Empire Traction Company has been incorporated for $20,000, by T. K. Beard, W. H. Frazine, W. F. Beard, J. M. Walthall and L. L. Dennett.

TRANSMISSION.

LIVERMORE, CAL.—The Livermore Water & Power Company is preparing to extend its electric lines to Sunol from Pleasanton, a distance of five miles.

SAN BERNARDINO, CAL.—The contract for the erection of the building for the central plant of the Southern Sierras Power Company here has been awarded to Chas. C. Moore Company of San Francisco.

RIVERSIDE, CAL.—The Southern Sierras Power Company has let a contract in Los Angeles for the construction of between fifty and sixty miles of distributing lines in Riverside and San Bernardino counties.

PROSSER, WASH.—The Pacific Power & Light Company has applied to the Board of County Commissioners of Benton County for a franchise for a term of 50 years for the construction of transmission lines within that county.

TWIN FALLS, IDAHO.—Mr. Bacon of the Beaver River Light & Power Company has made application for a franchise for furnishing light and power to the city. The matter will be taken up by the City Council as soon as Mr. Bacon can appear.

VISALIA, CAL.—Application has been made to the Board of Supervisors of the county of Tulare for a certain franchise granting the right to construct and for a period of 50 years to operate and maintain an electric power system upon certain highways in said county.

THE DALLES, ORE.—Engineers representing the Pacific Power & Light Company, Portland, are preparing to make surveys for a high power transmission line between Wallula and The Dalles. The proposed line will be 130 miles long, carry 66,000 volts and cost about $400,000.

CLOVERDALE, B. C.—The British Columbia Electric Company will soon commence the construction of a power line from this place to Blaine, Wash.

WHITE SALMON, WASH.—Preliminary work has been started on the power dam which is to be built at the Narrows near here by the Northwestern Electric Company.

SAN SIMON, ARIZ.—The Virtue Mining Company plans for the erection of an electric power plant in Cave Creek Canyon, with a distributing system to serve the many pumping plants in this district.

HAZELTON, B. C.—The Rocher de Bocale mine plans for the erection of a hydroelectric power plant for mine operation. John F. Cowan Salt Lake City, Utah, is interested in the development of this property.

GOLDENDALE, WASH.—The Pacific Power & Light Company has been granted a franchise for a transmission line from Goldendale to Centerville, a distance of about seven miles. The estimated cost is $7000.

KLAMATH FALLS, ORE.—It is the intention of the Siskiyou Light & Power Company, whose head office is at Yreka, Cal., to have all of its subsidiary plants connected by power lines with the main plant at Fall Creek, which is on the Klamath River below Keno, about forty miles from this city.

HANFORD, WASH.—The American Power & Light Company has acquired the Hanford Irrigation & Power Company and will operate in connection with its other properties. The local plant on Priest Rapids will be enlarged and the capacity increased. G. W. Talbot is president, and A. S. Grenier vice-president of this company.

PORTLAND, ORE.—The Mount Hood Railway & Power Company has assigned to the City of Portland the right to appropriate such of the waters of Bull Run as may be necessary for a domestic water supply but reserves the right to use all excess. This amiable adjustment should materially hasten the company's power development on Bull Run.

BELLINGHAM, WASH.—Arrangements have been completed with the Western Canada Power Company to supply the motice power for the Bellingham-Skagit interurban railway, now under construction between Bellingham and Mount Vernon by the Stone & Webster Corporation. The traction system will be in operation by the summer of 1912.

BOISE, IDAHO.—The Kuhn interests of Pittsburg have purchased the Swan Falls power plant on the Snake River, near this city, and the Boise interurban railroad, operating between this city and Caldwell. The consideration is reported to be $2,000,000. The Kuhns contemplate trolley line extensions from Boise to Ogden, Utah, traversing irrigation district.

REDDING, CAL.—Work upon the greatest electrical power plant ever attempted in California is said to have been begun in the big bend of Pitt River by the Northern California Power Company of this city. One hundred and twenty-thousand horsepower will be developed from 250,000 inches of water turned from Pitt River near the town of Wengler. It is estimated that the total cost will be $4,000,000. It will be by far the largest electrical power plant in the State. The ditches and tunnels will have a combined length of five and one-quarter miles.

STOCKTON, CAL.—The San Francisco & Sierra Power Company officials announced Tuesday, after the Supervisors had granted a franchise over the county roads from Manteca to Stockton, that inside of 60 days electricity would be furnished consumers here. For the past two weeks the company has had agents making the rounds of the business section securing contracts, and they will continue to work. It was stated that fully $300,000 will be expended in placing one of the finest underground systems in the State in the streets of Stockton.

EUREKA, CAL.—Negotiations have been practically closed here for the transfer of the Blue Lake light and power plant to the Western States Gas and Electric Company. The plant has been owned and operated a number of years past by the Minor Mill Lumber Company. With the purchase of the Blue Lake plant the electric light and power situation in Humboldt County will be under the complete control of the Western States. A year ago the Western States Company entered the Humboldt field by the purchase of the holding of the Humboldt Gas & Electric Company at a cost of over a million dollars. Subsequently it absorbed the light and power plants in Arcata, Fortuna and Ferndale and is now to take over the Blue Lake. Since the purchase of the Humboldt gas and electric system the Western States Company has spent over $250,000 in acquiring smaller plants of the county.

REDDING, CAL.—The Northern California Power Company is moving the construction equipment from its recently completed Coleman hydro-electric plant over to the big bend of the Pitt River, near Wengler, 67 miles north of Redding. A diversion dam for 250,000 inches will be installed for a new power plant with an estimated capacity of 120,000 horsepower. Water from Pitt River will be turned direct into a tunnel 6000 feet long and 24 feet wide by 26 feet high. In all there will be five tunnels. The combined length of the tunnels and canal will be 5 1-4 miles. The canal will be 32 feet wide at the bottom, 50 feet wide at the top and 15 feet deep. At the outlet a drop of 464 feet will be obtained. Only 850 feet of steel pipe line will have to be constructed at the lower end of the system, to connect with the water wheels. A unique feature of the tunnel work consists in the use of steam shovels for mucking throughout, something never attempted before in this state. A power line is being constructed 24 miles from the Kilarc station to the new site in order to supply current for operating the air compressors, etc., of the construction plant. Steel towers, spaced five to the mile, will be used instead of poles to carry three three-phase power circuits.

TRANSPORTATION.

ALBANY, ORE.—The contract for grading the electric railroad from Albany to Eugene has been let. It is predicted that electric cars will be running over this line early next year.

SEDRO-WOOLEY, WASH.—The Bellingham and Skagit County Interurban Railway Company has made application for a franchise to operate an electric lighting and power system in this city.

NATIONAL CITY, CAL.—The work of relaying the track of the electric division of the San Diego Southern Railway, between National City and San Diego, will start at once. New ties and heavier rails will be put in.

SAN DIEGO, CAL.—The City Council will receive sealed bids up to November 20th for the purchase of a franchise granting the right to construct, maintain and operate a street railway for a period ending September 1, 1952.

MEDFORD, ORE.—Messrs. Doyle & Narren, who represent a company which contemplates the construction of an electric railroad from Grants Pass to Ashland, Ore., have been in this vicinity looking over possibilities.

TUCSON, ARIZ.—Negotiations leading to the building of the proposed street railway extension from the present university terminus to a point a mile and a half east of the speedway, are being made with property owners by C. K. Durbin, representative of Sanderson & Porter Company. Property owners have pledged $40,000 worth of property to the company as an incentive. The company is now said to be asking for a larger guarantee.

NEW WESTMINSTER, B. C.—The British Columbia Electric Railway Company has made arrangements for fitting all cars now in operation with Westinghouse multiple unit controls. This installation involves alterations to the various truck bodies and cars are undergoing repairs.

STOCKTON, CAL.—The survey for the route of the Central California Traction Company's extension from its main line at Campton to Lockeford has been completed and the new feeder for the interurban road will soon be constructed.

ALBANY, ORE.—The Oregon Electric Railway is being rapidly extended from Salem to Albany so that it is likely that service will be ready between Portland and Albany by January 1st. President Carl R. Gray states that the extension to Eugene awaits only the acquisition of right of way.

SOUTH VANCOUVER, B. C.—The British Columbia Electric Railway Company has notified the residents of this place in response to communications urging extensions of car lines in this district, that action on extension work will not be undertaken this year on account of heavy construction work, but will be taken up next season.

REDLANDS, CAL.—C. S. Turrill, president of the Redlands University Railroad Company, recently organized with a capital stock of $15,000, has petitioned the Board of Trustees for a franchise to construct a line on Colton avenue from Orange street to Cook street, for fifty years, giving the privilege of carrying passengers, express and freight.

LOS ANGELES, CAL.—The Board of Supervisors has passed an ordinance granting to H. E. Huntington, a franchise to construct and for a period of 40 years to maintain an overhead crossing across El Monte road in the County of Los Angeles, and to construct, operate and maintain a double track electric street railway line thereover.

SAN FRANCISCO, CAL.—The announcement is made by the United Railroads that steps are being taken to bring the decision of the U. S. District Court of Appeals in the Geary street road case before the Supreme Court of the United States. Wm. H. Abbott says: "I am now preparing a petition for a writ of certiorari to take the decision of the Appellate Court before the U. S. Supreme Court. This will result in putting a stop to all proposed construction of the municipal road on Market street, and on Geary street west of Thirty-third avenue for at least two years."

BERKELEY, CAL.—Formal notification that the Southern Pacific was ready to convert its interurban lines in this city from steam to electricity, following the practical completion of new lines in this city and the reconverting of the old lines, was made by the company to the City Council at its meeting yesterday. The notice covered all its local lines north of Shell Mound Park, including the California street Solano avenue, and Ninth street loop, the Shattuck avenue line and the Ellsworth street line. Though no definite date was given by the company as to when it would be ready to convert the lines, it is announced unofficially that the change is to be made on the lower road on California and Solana street in November.

SAN RAFAEL, CAL.—S. M. Augustine and the Mt. Venice Co., have transferred 57 acres of their tract near McNear's Point to E. B. McNear of Petaluma. The purchase of so much land by the McNears in this locality recently has considerable significance, in view of the fact that John McNear is one of the directors of the Petaluma, Sebastopol and Santa Rosa electric road. Some weeks ago E. B. McNear increased his holdings in this locality, and it is reported that he is anxious to get more. People who appear to know, say that it is the intention of the Petaluma company to begin extending its line via McNear's Point in the early spring.